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THESIS

DESIGN AND IMPLEMENTATION OF ONLINE COMMUNITIES

by

Michael Del Grosso

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Thesis Advisor:	Rudolph Darken
Second Reader:	Ted Lewis

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13. ABSTRACT *(maximum 200 words)*

    There are many claims that building an online community on the Internet is the next big thing for online businesses to enhance their bottom line. Advertising has been the biggest moneymaker on the Internet so far so attention is money on today's Internet. The idea of an online community is to build communication tools into a website to allow visitors to interact with each other and encourage them to return often. By providing visitors with a place to interact with others and talk about their interests companies can better target them with advertising. Certainly a web site that brings users back over and over again is very appealing to any organization that is trying to sell goods or get their message heard. But the building of an online community is not as simple as just adding discussion forums and/or chat rooms to a web site. In fact, many believe that a successful community is only 10% dependent upon technology and 90% dependent upon people. This thesis takes a look at the principles of successful online communities according to current literature and then analyzes the application of these principles on some popular online communities. It then takes a detailed look at PRESENCE-Lite, an online community built by the author based on the principles of online communities.

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DESIGN AND IMPLEMENTATION OF ONLINE COMMUNITIES

Michael Del Grosso
Captain, United States Marine Corps
B.S., Virginia Tech, 1995

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Author: _____
Michael Del Grosso

Approved by: _____
Rudolph Darken, Thesis Advisor

_____
Ted Lewis, Second Reader

_____
Chris Eagle, Chairman
Computer Science Department

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ABSTRACT

There are many claims that building an online community on the Internet is the next big thing for online businesses to enhance their bottom line. Advertising has been the biggest moneymaker on the Internet so far so attention is money on today's Internet. The idea of an online community is to build communication tools into a website to allow visitors to interact with each other and encourage them to return often. By providing visitors with a place to interact with others and talk about their interests companies can better target them with advertising. Certainly a web site that brings users back over and over again is very appealing to any organization that is trying to sell goods or get their message heard. But the building of an online community is not as simple as just adding discussion forums and/or chat rooms to a web site. In fact, many believe that a successful community is only 10% dependent upon technology and 90% dependent upon people. This thesis takes a look at the principles of successful online communities according to current literature and then analyzes the application of these principles on some popular online communities. It then takes a detailed look at PRESENCE-Lite, an online community built by the author based on the principles of online communities.

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EXECUTIVE SUMMARY

This thesis reviews the current literature regarding online communities. The term "online community" is not an easy term to define but it is no harder than simply defining the term "community". The most concise way to describe the phenomenon of online community is a group of people that regularly interact via technologies provided by computer network communications. These online communities fulfill some need in the lives of its members.

Chapter (I) attempts to define what an online community is and some history of where they came from. It turns out that the idea of online community is not new and in fact is over 100 years old. It also takes a look at some of things people get from online communities and also some of the behavior that emerges from these gatherings of people.

Chapter (II) scans the literature and examines some of the common principles of successful online communities as well as real world communities. Much of the literature on this subject has been consolidated into a list of nine principles, which are common in online communities. Usability is also important in the establishment of online communities but surprisingly, bad user interfaces and systems can be overlooked by users if the community is compelling enough for its members.

Chapter (III) takes a look at some existing online communities and examines their implementation with regard to the social and usability principles laid out in Chapter Two.

Chapter (IV) examines the implementation of an online community built by the author for the virtual reality community. It is an online journal of academic works on the subject with mechanisms for members to discuss their work with others that are interested in virtual reality.

Chapter (V) is a brief conclusion of the thesis.

The appendices contain the software requirements specification, a usability study, and a listing of revisions pertaining to the project described in Chapter (IV).

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I. INTRODUCTION

A. MOTIVATION

The commercial Internet has taken off in the past decade. Almost every organization you can think of has carved out its niche on the Internet in one way or another. Businesses have used their "dot com" sites to augment their brick and mortar storefronts to sell their products and some companies have used the Internet *as* their storefront, streamlining their business models and saving them the cost of maintaining costly inventory. There are other organizations that have established themselves on the Internet not to make a profit but to share ideas, to meet new people, to play games, or to simply socialize. These types of sites have come to be known as "online communities".

Is there a relationship between online commerce and online communities? Should there be? Certainly, the fact that members of successful online communities return again and again to the site of their online community is appealing to anyone trying to make money on the Internet. But, can a business afford to establish a place on their "dot com" site for visitors (potential customers) to loiter around conversing with other visitors? Can they afford not to?

B. WHAT IS AN ONLINE COMMUNITY?

To understand what an online community is, it is only necessary to understand what a community is in the material world. Communities are groups of people with similar interests that meet, share ideas, and basically fill a need in each other's lives. Communities form around churches, playgroups, or even a tavern. People can belong to many different communities simultaneously, such as a neighborhood social group, a group of friends at a weight club, a bike-riding club, and now with the Internet a person can be a member of an online community, as well.

In the early days of the World Wide Web (early 1990s) there was a mad rush for businesses to figure out how to capitalize on the Internet. There were many books published offering suggestions on how to break into this new domain. The term "online

1

community" was referenced as a peripheral component to online business goals or even a potential impediment to them (Werry, 2001). One text in particular, *How to Make a Fortune on the Information Superhighway*, written by Canter and Siegel in 1994, claimed that there was NO community on the Internet. These authors looked at the Internet as a frontier to be conquered by pioneers. They even described establishment of a presence on the Internet as a "homesteading race" (quoted from Werry, 2001). The rush was to claim a piece of cyberspace real estate and set up a virtual mall.

However, there were already residents on the Internet frontier, such as scientists, academics, students, and hackers. Canter and Siegel described these residents as "incapable of self-government, …having the wrong mental attitude toward private property, [and] as prone to committing criminal acts…" (Werry, 2001: 8). They used this description to support the idea that there was no online community out there, thereby clearing the way for the free spread of commercial ventures and advertising.

In 1995, the interest in online communities was renewed. A possible reason for this is the utter failure of the online virtual mall business model (Werry, 2001). Businesses needed a new way to reach out to the users of the Internet and invite them into a community where they could expose them to targeted advertising. It was no longer about selling products but "capturing eyeballs" (Werry, 2001: 11). Attention is the currency in cyberspace and now the goal of commercial web development was to draw people to sites and keep them coming back; this is referred to as "stickiness" (Preece, 2000). "Dot coms" started adding discussion forums, chat rooms, games, and bulletin boards to capture net surfers' attention (Werry, 2001). By connecting people with similar interests, businesses were better able to gather demographic information and focus advertising more effectively at a particular audience.

C. THE FIRST ONLINE COMMUNITY

The WELL (Whole Earth 'Lectronic Link, www.well.com) was established in April 1985, shortly before the Internet's 16th birthday and years before Tim Berners-Lee created the World Wide Web (Berners-Lee, 1999). However, it could be argued that the scientists and academics who first communicated on the ARPANET during the early 70s

were really the first online community. In reality, the first online community predates even the ARPANET by over 100 years. The first "netizens" communicated on the 19th Century's version of the Internet, which Tom Standage calls "The Victorian Internet" (Standage, 1998).

The Victorian Internet was actually the intricate network of communication links created for the worldwide telegraph system. There were many parallel incarnations of the telegraph system but the predominant system was the one created by Samuel Morse. This network very much resembled the Internet that we have today in that it was a network of networks extending throughout much of the world. The similarities don't stop there. The Victorian Internet spawned an extensive online community of bankers, businessmen, traders, etc. Early entrepreneurs quickly figured out how to benefit from the rapid communication made possible by the telegraph system. However, money was not the only thing drawing people together online in the 1800s. A close-knit community of telegraph operators, or telegraphers, held the fabric of this network together. (Standage, 1998)

Telegraphers were people that had to transmit and receive every message that was sent over the wire. As the popularity of telegraphy grew, so did the skills of telegraphers. They created their own codes and abbreviations to communicate with one another such as "I I" for "I AM READY" and "S F D" for "STOP FOR DINNER". When traffic was slow they socialized, gossiped, and even played games with each other over the network. Each operator even created his or her own distinctive signature and style that was recognizable by other operators. Telegraphers even began to form cliques, preferring only to work with others of similar skill. This resulted in some inefficiencies in the telegraph offices since some operators would only work lines on which they could work with their online buddies. (Standage, 1998)

There are many examples of modern day online relationships blossoming into marriages. One notable example is the relationship established by Steve Heller and Susan Spino. Heller solicited for a stranger to interact with him via email to teach that person the programming language C++. The result of this relationship was not only a book, *Who's Afraid of C++*, but a marriage between Heller and Spino (Heller, 1996).

This very thing actually happened on the Victorian Internet, as well. In 1891, a story was published recounting the story of John Stansbury, an operator in Yuma, Arizona, and a female operator from Banning, California named "Mat". The two communicated for months and they became good friends. Stansbury mistook "Mat" to be a man when in reality she turned out to be a woman. When they finally met, they immediately fell in love and were married. (Standage, 1998)

D. WHY DO PEOPLE JOIN ONLINE COMMUNITIES?

People naturally coalesce into communities to fulfill some need. Ancient man formed communities or tribes for the safety of numbers, to form teams to enhance their ability to collect food, and probably just to socialize. Modern man has similar needs today. In fact, Abraham Maslow, a humanistic psychologist, has arranged these needs in a hierarchical fashion. This hierarchy is called "Maslow's Hierarchy of Needs". From the lowest to the highest, these needs are arranged as follows: physiological, security/safety, social, self-esteem/ego, and self-actualization. His theory claims that if a lower level need is left unfulfilled then people cannot possibly pay attention to any of the higher level needs. (Kim, 2000) It is often useful to refer to this "Hierarchy of Needs" when developing online communities since people can actually meet some of their needs there. Most people join online communities for the social aspect of them but that depends on the nature of the community. Some sites can offer people self-esteem and self-actualization that they find difficult to find in the real world. In some gaming communities, players even form clans to provide the lower level needs for players such as food and shelter as well as safety from other clans. Professional societies form online communities so their members can share their research and get new ideas from peers anywhere in the world. This broadening of horizons on such a large scale would not be possible without online communities.

E. WHAT ARE THE BENEFITS?

There are many benefits to building online communities. The Internet is huge and it is very, very easy for someone to click their way out of a website if it doesn't give them

what they are looking for. Getting people to return to websites has been a goal of web designers from the beginning of the World Wide Web. Just providing users an easy way to buy things from a website is not enough to establish loyalty and return visits. However, if the site offers something more than that, something else that the visitor needs or wants, then that user is more likely to come back. Suppose a user buys a certain software package from a website. If that website offers tutorials and ideas to use the package then the user may come back a few more times. But if the site offers a way of interacting with other users who have downloaded and are using the same software package to share ideas and a way of posting user-created work, then the site has fulfilled an additional need for that user and he is more likely to return. Now, with the good experience this user is having with the software and with the sociability offered by the website, that user is more likely to tell others of the positive experience he is having with the product and to encourage them to visit the site as well.

1. Profit versus Function

It is relatively inexpensive to implement features common to an online community, such as message boards, online forums, and chat rooms. Starting small with minimum investment and more importantly, with a solid goal in mind, building an online community, instead of just a commercial website, can enhance customer loyalty and can greatly increase traffic on that site. That can translate into increase sales and thus increased profits. Happy customers return more often than unhappy ones.

Another less obvious benefit for businesses is that just by membership in a community a person has exposed something about himself; an interest. From there it is not difficult to profile users of online communities and focus advertising to their particular demographic. This is good for business and is also probably good for the consumer because they are being made aware of products that will likely interest them. Now users return to the online community because it offers everything that they need or want in one place, thereby saving them time and effort.

2. Tribalism

There is an increasing tendency for consumers to seek out and band together with other consumers forming tribes of people with similar interests or ideas. Historically, people formed tribes out of necessity for protection and to economize the gathering of food. Nowadays, the Internet is providing a full-time communications medium around which modern tribes are forming. A company that can cause consumers to coalesce into a tribe, which is loyal to that company's product, has a distinct advantage in the marketplace. Loyal customers become emotional about products and emotional people tend to spend more money. Tribes have all formed around the products made by the Saturn automobile company, Harley Davidson motorcycles, and Apple Computer company. Now with the timeless communications provided by the World Wide Web tribes or communities are being formed around ideas as well as material products. (Lewis, 1999)

F.   WHO SHOULD BUILD ONLINE COMMUNITIES?

It takes a unique mix of human qualities to build a successful online community. It's not enough to be savvy with the technology to actually code the website. It takes someone with a desire to bring people together and an understanding of who they are and what their needs are. People are people everywhere they go, including when they are online so the same basic things that attract people to real world communities will attract them to online communities. If your goal is to bring people together in the virtual world and keep those same people coming back over and over again then an online community is for you.

II.   PRINCIPLES OF BUILDING AN ONLINE COMMUNITY

Putting a chat room or a bulletin board on a web site will not necessarily make it an online community. People form communities, so to create an online community it must be one that attracts people and keeps them coming back. There are two types of principles to consider when designing online communities: social principles and usability principles. To develop a successful online community, developers must design usability into the software on which the community will interact and that software must support sociability between the members of that community (Preece, 2000).

There is no magic formula or cookbook approach to building a successful online community. Ignoring social principles over usability principles or vice versa will spell certain doom for an online community. There has been a tendency to build online communities using cutting-edge graphical interfaces while ignoring the sociability of these virtual worlds. "Many of these systems have more in common with lonely museums than with the vibrant communities they set out to create." (Kollock, 1996)

A.   SOCIAL PRINCIPLES

Building a successful online community is very similar to building a community in the real world. Like the real world, similar interests, a common goal, or just a need to socialize brings people together into communities. Many of the principles that make a successful real-world community also make a successful online community. The key to remember is that people are people everywhere, even when they are online. (Kim, 2000)

1. General

When a person first moves into a neighborhood, the feeling of community is not yet established. If the neighborhood is far from family and friends and the previous home, then the newcomer feels like an outsider. Where is the grocery store? What areas should I avoid? Where are the good restaurants? A new member in the community wants to fulfill their basic needs first, such as a place to live and where to get food. Once those needs are met then the matter of safety is addressed. Of course, these issues are likely resolved before the move even takes place. But once those needs are met then a

person needs to know where to socialize and meet with people who have similar interests. After the newcomer is established in a group of like-minded friends that person begins to establish an identity in the community. Over the course of time a person becomes more and more familiar with the area and the other people living in it and suddenly feels like part of something larger than himself – a member of a community.

But, there is more to a community than just knowing friendly places to hang out. Community is hinged upon the interaction of people within the community. Do community members cooperate with one another or do they look after selfish interests?

> At the root of the problem of cooperation is the fact that there is often a tension between individual and collective rationality. This is to say that in many situations, behavior that is reasonable and justifiable for the individual leads to a poorer outcome for all. Such situations are termed *social dilemmas* and underlie many of the most serious social problems we face. (Kollock, 1996)

In his book, The Evolution of Cooperation, Robert Axelrod (1984) takes a close look at the famous two-person social dilemma called the *Prisoner's Dilemma*. He identifies three conditions which must be present for there to be cooperation between two people. First, there must be a likely chance that these two people will meet again. Thus a person's actions are known to another person thereby giving these people a collective history. Second, these people must be able to recognize each other, in the present as well as in the future. Third, each person must know something about the history of the other person. This can also be seen as a reputation. If a person knows that others will know his or her history they are less likely to act selfishly since they know they can be held accountable for their actions.

Elinor Ostrom (1990) takes these ideas one step further by examining the interactions between entire communities and not just person to person relationships. She offers seven design principles of successful communities. (Ostrom, like Axelrod, did not consider online communities in her work.) (Kollock, 1996) 1) There must be a clear boundary around groups to discourage individuals from entering the group, taking what they want, and then leaving without ever contributing to the group. 2) Groups must be able to establish their own rules to govern themselves. 3) Individuals in the group must

have input in the establishment and modification of these rules. 4) External authorities must respect the group's right to govern itself. 5) There must be a system in place for the group to police itself. 6) The group must have a method for imposing sanctions on members who violate the rules. 7) Group members must have access to some low-cost method of resolving conflicts.

2. Online

Online communities aren't much different from real-world communities; they are just established through carefully designed computer interfaces. Many of the same community principles proposed by Axelrod (1984) and Ostrom (1990) still apply. However, online communities can evolve much more rapidly. It may take years for a real-world community to develop but online communities can develop in months, weeks, days, or even hours. That is why it is very important to follow three simple rules when designing an online community: design it to be scalable, provide a means to get feedback from members, and empower your members over time. (Kim, 2000)

Using the WELL (Whole Earth 'Lectronic Link, www.well.com) as his model, Mike Godwin (1994) proposed nine principals for building successful virtual communities: 1) Use software that promotes good discussions, 2) Don't impose a length limitation on postings, 3) Front-load your system with talkative, diverse people, 4) Let the users resolve their own disputes, 5) Provide institutional memory, 6) Promote continuity, 7) Be host to a particular interest group, 8) Provide places for children, 9) Confront users with a crisis. Many of these principals echo those principals mentioned earlier but are meant to be specific to online communities.

Most of Godwin's principals are self-explanatory but some warrant further discussion. A community that brings together all like-minded and complacent people is likely to be very boring. People in communities must have something in common or they would not come together but the community becomes more interesting when it has some different-minded people in it to spark interesting discussion.   "May the fire of controversy melt the ice of apathy" (author unknown). Institutional memory constitutes the history of the group. It gives those that contribute a sense of ownership and newcomers a sense of belonging to something larger than themselves. Introducing a

crisis in an online community is not an easy thing to do outside of the more elaborate multi-user dungeons or domains (MUDs) but people tend to pull together when something bad happens in their community (Godwin, 1994).

Perhaps the best set of principles regarding the development of online communities come from Amy Jo Kim (2000). In her book, *Community Building on the Web*, she spells out nine principles of successful online communities: 1) define and articulate your PURPOSE, 2) build flexible, extensible gathering PLACES, 3) create meaningful and evolving member PROFILES, 4) design for a range of ROLES, 5) develop a strong LEADERSHIP program, 6) encourage appropriate ETIQUETTE, 7) promote cyclic EVENTS, 8) integrate the RITUALS of community life, and 9) facilitate member-run SUBGROUPS (Kim, 2000). Kim (2000) does the best job of capturing the principals of online communities by Godwin (1994) as well as the principals of offline communities by Axelrod (1984) and Ostrom (1990) detailed earlier in a concise, yet thorough, list of principles for establishing successful online communities:

a. Purpose of the Community

Online communities must meet some need in people's lives. There is no universal need so the intended audience must be identified. Hagel (1997) identifies three types of communities: 1) geographic, defined by location; 2) demographic, defined by age, race, gender, and nationality; and 3) topical, defined by a shared interest, such as a fan club. Kim (2000) adds a fourth type of community: activity-based which is defined by a shared activity such as gaming. Online communities typically fall into at least one of these categories. The categorization of an online community helps to define who the intended audience is and what purpose the community will serve.

It is also helpful for an online community to have a mission statement. A mission statement should be concise and answer the following questions: what type of community this is, why it was built, and for whom it was built. This mission statement helps to establish the boundaries of the community, as suggested by Ostrom's (1990) first principal of successful communities.

Two of Godwin's (1994) principals are also captured here, specifically, principals 7 (be host to a particular interest group), and 9 (confront users with a crisis).

Again, it is not easy to concoct a crisis to impose on an online community but many communities exist to provide support for members who share similar personal crises.

b. *Places for Members to Gather*

Members must have places in the community in which they can meet to do or discuss things in which they have a common interest. These places must be comfortable and encourage open discussion, like the "Great Good Place" discussed by Oldenburg (1997). These places can take the form of a mailing list, a discussion forum, a chat room, or a virtual world.

Two more of Godwin's (1994) principals are captured here: 1 (use software that promotes good discussion) and 2 (do not impose length restrictions on postings). Axelrod's (1984) cooperation requirement that there exist a possibility for people to meet again is captured here as well. Members of successful communities will continually run into one another and the regulars will become well known. A successful community will be a place "where everyone knows your name".

c. *Persistent Member Profiles*

To have a real community you must know who your members are. Members must also be able to learn about and interact with each other. People have a need to know whom they are communicating with. The virtual world does not represent the visual cues that people rely on during interpersonal communications very well so member profiles fill a very important role in developing a meaningful social infrastructure. (Kim, 2000) Of course, the absence of visual cues can lead to some deception amongst members as they experiment with different roles or genders. Some interesting papers on identity experimentation in cyberspace are Donath (1999), Burkhalter (1999), O'Brien (1999), and Sagan (1995).

The amount of profile information collected from members initially can also set the tone for the community. The collection of little information enables users to be more anonymous and vice-versa. Required profile information can also help to clearly define group parameters, as suggested by Ostrom (1990) by discouraging those not likely to contribute or benefit.

Profile information also provides history for the community by keeping track of the activities and accomplishments (as well as misdeeds) of its members. Individual member history composes a collective group history that fosters individual ownership in the group. This monitoring of members' behavior satisfies Ostrom's (1990) fifth design principle.

Creating and maintaining continuously evolving profiles of members satisfies the second (people must be able to recognize each other) and third (people must have information regarding their behavior until now) cooperation requirement presented by Axelrod (1984). This also captures Godwin's (1994) principles of providing institutional memory and continuity.

d. Member Roles in the Community

There are many roles to be filled in a community. There must be someone at the door to greet newcomers and someone to be around to answer questions. There should also be someone around to deal with troublemakers. (Kim, 2000) But, every member of a community should have some role, even if it is just as a visitor. Everyone in every type of community starts out as a "newbie" and then, if they remain a member, they become more of a regular. A successful online community will communicate to its members what roles they are filling, what roles other members are filling, what other roles exist, and what status each member holds in the community. A member's role should clearly define what he or she is capable of doing in the community and it should be easy for members to ascertain the roles of others.

An important role to fill early in the life of a community is that of a facilitator or discussion leader to get the ball rolling. Godwin (1994) calls this front-loading your community with interesting, talkative, diverse people.

Every member should have the role of contributor to the community. Even if they do not wish to, they should be afforded the opportunity to voice their opinions regarding the rules of the community (Ostrom, 1990).

e. Community Leadership

Leaders set the tone for the community and fuel or stifle its growth. Leaders in the community moderate discussions in chat rooms and forums, keeping them focused, they police members' behavior, they resolve conflicts between members, and they impose sanctions on those that break the rules. (Kim, 2000) An effective leadership program is essential to a successful online community.

Many of Ostrom's (1990) principles are captured here, specifically, 4) external authorities respect members rights to make their own rules, 6) a graduated system of sanctions is in place, and 7) members have access to low-cost conflict resolution mechanisms. Godwin's (1994) fourth principle, allowing users to resolve their own disputes, is covered here as well.

The leadership in virtual communities has to be prepared to deal with unexpected behavior of its citizens as well as outright criminal behavior. The popular online community, Ultima Online, had an outbreak of criminal behavior that almost collapsed the entire economic system of the virtual world. Counterfeiters capitalized on a software bug that enabled them to reproduce gold pieces whenever they wanted. The extraordinary wealth they accumulated led to virtual hyperinflation and the other members of the community were reduced to bartering. Besides repairing the exploited bug, the leadership of Ultima Online decided to retire some of the excess gold from the game by holding, amongst other things, an auction for red hair dye for use on players' avatars. The status associated with this red hair dye caused players to line up their avatars for hours to get some of it. (Kolbert, 2001)

Ultima Online (UO) was also the stage for one of the first public displays of virtual civil disobedience. When the developers of UO failed to address numerous system bugs a player, Mohdri Dragon, initiated a public riot of hundreds of UO residents in which they stripped their avatars naked and stormed the castle of Lord British (the character of the game's real-life founder, Richard Garriott). Once inside, the rioters trashed the interior of the castle shouting profanities while the developers looked on in amazement. (Kim, 1998)

f. *Appropriate Etiquette*

A community must have rules that govern how its members should conduct themselves. These rules should be explicitly defined in a community constitution or similar document and there should be a process for modifying this document so that it evolves with the community. (Kim, 2000) This document does not have to be very complex and in fact should be as simple as possible. More importantly, the leadership of the community must enforce the rules contained in this document.

Ostrom's (1990) second principle of successful communities regarding the rules governing the use of collective goods matching local needs goes here.

g. *Events to Bind Members Together*

Regular events bring a community closer together and build ties amongst its members. Events are things like regular celebrations such as a community founding or a real-world holiday as well as contests that reinforce a community's identity. (Kim, 2000) Events enhance any community by bringing people together for some special reason. Some real world examples are Sunday dinner or a Saturday card game. In the cyber world, events can be games, tournaments, or special chat room guests. Events give depth to the community by giving members common history of shared experiences and topics to stimulate discussion.

Events can also include those that are specific to individual members of the community; things like birthdays, anniversaries, or other personal milestones. The recognition of individuals builds their sense of belonging in the community.

h. *Celebration of Rituals*

At one time or another, all members of a community go through some sort of transition, such as marriage, promotion, or a birthday. Communities should recognize and celebrate the transitions experienced by its members. It should also recognize important holidays and milestones shared by the community. (Kim, 2000)

Many multi-user dungeons (MUDs), where avatars in a virtual world represent members, regularly conduct virtual marriages between members. Some have evolved into codified and elaborate rituals. In WorldsAway an oracle conducts the

wedding in the presence of the bride and groom and all of the invited guests. If there are too many guests the extras attend in disembodied ghost form. After the bride and groom complete their vows they pop the heads off their virtual avatars and briefly exchange them thus completing their union in cyberspace. (Rossney, 1996)

i. Subgroups Within the Community

As a community grows it will inevitably develop within itself smaller groups with similar, more focused interests. Recognizing these subgroups can enhance member loyalty by letting them feel that the community is evolving with the needs of its members. (Kim, 2000) Care must be taken when allowing the formation of subgroups. A popular subgroup can split off on its own taking with it a large number of community members. The same principals that apply to the whole community should apply to subgroups as well. Subgroups should be allowed to establish their own rules, as per Ostrom's (1994) fourth principal, as long as they don't undermine the community as a whole.

B.   USABILITY PRINCIPLES

1. General

Usability is not just applicable to software and cyberspace communities. It is also engineered into the real world. In real world communities, roads are marked and signs direct us to where we want to go. Stores are organized so that we can get in, find what we want, and get back out. We probably take many of these things for granted but once you have visited a poorly organized store or gotten lost because of a missing road sign you come to appreciate usability. Usability is something that most people do not notice unless it is poor.

2. Online

Usability is just as important to online communities as it is to any other type of software, and probably more so. If a web site is too difficult to navigate or forces users to learn too many "tricks" to access material then they are just a click away from using

another site which is more accommodating. Usability must be designed into an online community right from the beginning.

There are three basic usability building blocks to consider when developing online communities: tasks that users will accomplish, the users themselves, and the software that is available to the developer or is required to support the other two building blocks (Preece, 2000).

a. Users

A community is not a community without people so it makes sense to consider who these people will be. By using a user-centered development process the developer looks at the site from the perspective of every kind of user that is likely to use it. This is not an exhaustive list but some things to consider are gender, ethnicity, technical ability, physical abilities or disabilities, and age. Considering these things early in the development process reduces the chances of having to redesign the site later at huge costs of time and money because it fails to meet the needs of its users. (Preece, 2000)

b. Tasks

What kinds of things will users be doing on this site? Will they be chatting with other users in real time or will they be posting messages to a bulletin board? It is important to have a good feel for what users expect while using the online community. Making assumptions about this will typically lead to a poorly designed site, therefore it is critical that developers *ask* potential users explicitly what they want to get out of the community and check with them periodically throughout development to make sure these needs are being met.

There are many reasons to establish an online community but some common examples of high-level tasks in an online community are the exchange of information, emotional support for users, socializing and meeting people, and to discuss ideas. These high-level tasks can then be broken down into some medium-level tasks, such as posting messages, conducting or participating in live chats, searching for information, and responding to messages. (Preece, 2000)

c. *Software*

The great thing about software is that it makes almost anything possible for an online community, given a technically savvy developer and some imagination. But just because anything is possible and it can be done is not a good reason to do it. If users fail to notice the interface then it was probably designed well. The following principles will help ensure the development of a usable online community.

Consistency - Every page on a site should have a similar look and feel. Layouts and color schemes should not change from page to page within a particular topic. For example, ESPN.com uses a different color scheme for each sport but the basic navigation structure remains the same. Too many differences are confusing and can make the user feel as though they have left the site they started from. Standardize these elements from the beginning of the design. (Pearrow, 2000)

Simplicity – Every effort should be made to make every element of the site clear and concise. For instance, a section for job opportunities should be called "Jobs" and not "Opportunities". It is tempting to use fancy and elaborate color schemes but it is better to stick to convention. Remember that users typically scan a web page as opposed to reading it in detail. Put things where they expect to find them and avoid lengthy explanations. A standard convention is that the site identification (logo) appears at the top of the page, navigation links go down the left side and content appears to the right of the navigation and below the site ID. (Krug, 2000)

Universality – It is better to avoid "bleeding-edge" or browser-specific technologies (Pearrow, 2000). Browsers support elements differently so it is important to check the web site regularly using multiple browsers. An element that looks great in one browser may not even show up in another. Don't cut out potential users by using proprietary technologies.

Predictability – Users want to be in control. By using clear terminology and simple navigation, users find a site reassuring to use and things easy to find. Predictable behavior increases user confidence and encourages them to return to the site, which is the point of designing an online community in the first place. (Krug, 2000)

C.   SUMMARY

> …technology does not make worlds interesting.   People do. …[developers] need to give users the tools they need to build their own culture. And then, they will need to get out of the way. (Rossney, 1996)

Every online community is different and there is no procedure to follow to create a successful one. Online community development is a dynamic and evolutionary process requiring multiple iterations to reach the right design. It is important to remember that a community, online and off, is made up of people and for it to be successful it must support what those people want to do. Kim (2000) effectively captures the principles of Axelrod (1984), Ostrom (1990), and Godwin (1994) in a concise list of nine principles for building online communities. By combining these nine principals with the usability principals discussed above, we will take a look at some case studies of existing online communities. Jenny Preece's (2000) theme, design usability and support sociability, summarizes the big-picture goal of building an online community very well.

III. CASE STUDIES OF EXISTING ONLINE COMMUNITIES

This chapter takes a look at some online communities currently available. Two of these communities (The WELL and the Blacksburg Electronic Village) will be analyzed in detail according to the principles laid out in Chapter II. The remaining communities will be quickly surveyed highlighting the features that make them online communities.

A. THE WELL

Figure 1.   The WELL Homepage.

1. Background

Stewart Brand, the creator of the Whole Earth Catalog, and a philanthropist named Larry Brilliant created the WELL (Whole Earth 'Lectronic Link – www.well.com) in the San Francisco area in 1984. It was designed as a subscription service where members paid a monthly membership fee and an hourly use charge to login and discuss myriad topics with other people. The idea was revolutionary and laid the

groundwork for online communities in the future, such as America Online. The WELL is still going strong and is considered by many to be the consummate online community.

Cliff Figallo (1998) was the first director of The WELL. In his book, *Hosting Web Communities*, he presents a spectrum of interactivity in online communities with cafés at one end, shrines at the other, and theaters tying the two together. The WELL would be considered a café on this spectrum because it exists solely for the interaction of its members with one another. In spite of its primitive text-only interface early on The WELL was very successful because its founders did a very good job of selling members to each other. Some of the early staff members of The WELL had been long time residents of a large commune in Tennessee for over 10 years, Figallo included, and they used their experiences with raw human interaction to help keep The WELL going. (Hafner, 2001) I like to think of The WELL as a commune without the destitution.

2. Social Principles

a. Purpose of the Community

The WELL was created simply to give people another way for them to interact with other people. It was purely social in nature. Members of The Well established very strong ties with the online community created by The WELL. Many members poured their hearts and souls into The WELL and it gave them a forum on which to discuss very intimate details of their lives. One member, Maurice Weitman, detailed to his community friends the story of his twelve-year search for his birth mother, who had given him up for adoption as a baby. He found the strength to call her from the community of friends he had on The WELL. He did contact his mother and the whole community rejoiced with him when she welcomed him into her life once again. (Hafner, 2001) Clearly, The WELL fulfilled many important needs in the lives of its members.

b. Places for Members to Gather

The WELL is organized topically in discussion forums called, "Conferences". Conferences are built around the interests of a particular member and that member, in exchange for subscription fees, runs the conference by posting musings, interacting with other members in the conference, and keeps the discussions on topic.

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Users can also directly interact with one another using an instant message sending utility called "Send". Many members interact through direct email as well. Since the founding of The WELL there has been a monthly party in which members can see each other face to face. (Hafner, 2001 & Figallo, 1998) This has probably been a major reason for the long-time success of this online community.

c. Persistent Member Profiles

Members are in charge of maintaining their own member profiles and keeping them current. They select a username upon registration and that username stays with them as long as they are members. Although they can modify their screen name any time they want the username is persistent and is attached to everything they ever post to the community. There is no anonymity on The WELL. The motto for The WELL is that "you own your own words" and members can expect to be held accountable for those words. (Hafner, 2001)

d. Member Roles in the Community

Conference leaders are very key players on The WELL. They keep the conversations flowing and keep everything interesting. These members are carefully selected to maintain a continuous flow of discussions. Many of these members are very outspoken and controversial and this tends to keep things lively on The WELL. The Directors are there to resolve the inevitable conflict that arises from time to time when a lively discussion gets out of hand. According to Figallo (1998), this happens about every six months.

e. Community Leadership

In the early days of the community the line between the leadership roles of the directors and the other members became blurred. The Directors spent so much time interacting with the community on such a personal basis that members saw them more as peers in the community than leaders in the community. This made intervening in online flame wars between members difficult to referee. When the Directors stepped in to mediate they often drew fire not only from the combatants but the other members of the community as well. (Hafner, 2001) Leadership had to walk a fine line between getting

involved with the community to understand its needs and distancing itself enough to be effective at mediating disputes. This takes a very special person, especially in the purely social environment found on The WELL.

f. Appropriate Etiquette

Conference leaders set the tone for their particular conference but the posts of other members also have a great influence. A member of The WELL will draw fire from not only the leadership of The WELL but also from the other members if they fail to show proper courtesy and respect. The membership of The WELL is predominately well-educated men and women and posts to the site reflect that. Although free speech is coveted on The WELL, personal attacks are not. It is okay to criticize another's ideas but it is not okay post judgmental comments about another person. The rule from the beginning has been that "you own your own words". (Hafner, 2001)

g. Events to Bind Members Together

In the entire history of The WELL there has been a monthly party where members can meet one another in person. This one regular event has probably contributed more towards keeping the community going than anything else. (Hafner, 2001 & Figallo, 1998)

h. Celebration of Rituals

Many members of The WELL go out of their way to recognize important events in the personal lives of others. Howard Rheingold (2000), a "WELL Being" from the beginning, claims that The WELL is so much like a real community because it is grounded in his everyday "real world" life. As of 2000, he has attended three weddings and delivered two eulogies for people that he has met through The WELL. (Hafner, 2001)

i. Subgroups Within the Community

As of right now there are 21 conferences on The WELL, each of them forming a sub-community of its own. Within each of those conferences are more sub-conferences, which makes up even smaller sub-sub-communities. Members are free to

"go over the wall", that is read and contribute to as many of these conferences as they like. Enthusiastic members run each of these conferences and sub-conferences. Any well-known and trustworthy member can host a conference by request or at the request of the staff. (Hafner, 2001)

3. Usability Principles

The interface to The WELL is very clean and simple. It in no way interferes with the users' ability to find what they are looking for. During the early days of The WELL the system was run on a VAX system using a quirky software package called "Picospan". It was not particularly easy to use but many members claimed that it added character to the whole WELL experience. (Hafner, 2001) The system has been significantly upgraded since those early days and can be accessed through the Internet via a very well done web interface.

a. Users

The target audience for The WELL is not necessarily computer savvy people but people who just want to socialize with other people that share similar interests. In the beginning, all a WELL Being needed was a computer and a modem to dial in directly to The WELL. Nowadays, all that is needed is an Internet connection.

b. Tasks

Members need to be able to login to the system, read and submit postings, and locate and contact other members.

c. Software

Consistency – All pages and conferences have a similar look and feel to them. Each page has the same color scheme and has the same navigation links at the bottom so it is very easy to move around.

Simplicity – The site is very simple to navigate. The visitor is greeted by a very clean and well-arranged home page with current events posted right in the center of the page and navigation links across the top and bottom of the page. The navigation links use very straightforward terms like "Join" and "Enter The WELL". The

Conferences page simply lists all of the available conferences in two columns. Just click the title, login, and you are in. It is very well done.

Universality – The WELL does not make use of any bleeding edge web technologies and displays identically in the top three browsers (Explorer, Netscape, and Opera). This makes the site very accessible for all users.

Predictability – The site is very straightforward to navigate and access information. Hyperlinks are all in a bolded red font with an underline. No surprises.

B.   THE BLACKSBURG ELECTRONIC VILLAGE

Figure 2.   The Blacksburg Electronic Village Homepage.

1. Background

The Blacksburg Electronic Village (BEV – www.bev.net) is truly a remarkable online community founded in the town of Blacksburg just outside the campus of Virginia Polytechnic University and State University. The BEV officially opened its doors on 25 October, 1993 and has been steadily growing ever since. The initial idea was very

simple: hook up as many people as possible as quickly as possible. Early proponents of the BEV believed that if they built it, people would come to it. Unfortunately, it wasn't that easy. Technology alone does not make successful online communities, it is important to teach people a new way to communicate with each other. In spite of the slow start Blacksburg enjoys the highest per capita use of the Internet in the world; 99% as of late 1999. Also, more than 75% of Blacksburg businesses are using the Internet for commerce and advertising with more than 475 business listings on the Blacksburg Electronic Village. (www.bev.net)

Blacksburg Virginia is a small town of approximately 38,000 residents. In a small town like this it is easier for residents to get to know each other than in some sprawling metropolis. In this small, close-knit community there was some resistance early in the project claiming that the network would reduce human contact in the town but time has proven that the opposite is the case. The online community has actually enhanced the sense of real community in the town and has allowed residents to become closer to each other than they have ever been in the past. Residents of all ages are more physically involved in every aspect of the community than ever before.

Although there are some active members of the BEV that are not local, the majority of the members are local residents. The BEV was founded as a supplement to the "real world" community of Blacksburg and so it provides many practical links to local government and businesses as well as an online place for people to meet to socialize. However, most of the online socializing really just facilitates physical meetings between residents.

2. Social Principles

a. Purpose of the Community

The Blacksburg Electronic Village fulfils many needs for its members. Members use it to enhance communications with local government, businesses use it to advertise their services, and schools are using it to educate children. In addition to all of these practical applications there are many that use it just to communicate and socialize with other members. One older member, Joe, fell and broke his hip one winter. He was

laid up in bed for almost two months but was able to stay in daily contact with all of his friends through the BEV Seniors mailing list and email. The asynchronous nature of the communications allowed Joe to post messages during the day and his friends were able to post replies at their convenience. The frequent contact with friends greatly helped Joe recover from his injury and provided his friends with a way of supporting him, which would have been impossible without the BEV. (Cohill, 2000)

b. Places for Members to Gather

BEV relies very heavily on newsgroups and listserv mailing lists for members to stay in contact with one another. There are twelve newsgroups and three special interest groups for members to participate in and they are all accessible from the BEV website. There are also five mailing lists. An experimental new place for members to meet is Moosburg. Moosburg is a graphical virtual environment being developed by the Virginia Tech Center for Human-Computer Interaction as a community-based online resource modeled after Blacksburg itself. The goal is to increase synchronous communication of the community online. It is meant to be an online meeting place where members can meet to share ideas and socialize. (moosburg.cs.vt.edu) The goal of the BEV is really to facilitate real-world meetings and enable exposure of local businesses, clubs, and special-interests more than provide online hangouts so these meeting places provided are appropriate.

c. Persistent Member Profiles

Members of BEV do not really have online profiles but one group, the Seniors group, require new members to send an email to the BEV Seniors newsgroup as an introduction, to include background and interests. Members get to know each other better through regular physical meetings. The Seniors group publishes a list of all of its members on its page on the BEV. Their profiles are persistent in the ongoing personal relationships between members.

d. Member Roles in the Community

There are not a lot of formal roles held by members of the BEV since there are no chat rooms or moderated forums. Members contribute what they can based on their interests and talents.

e. Community Leadership

The Seniors Group has a steering committee of community leaders, which are the keys to its success. These community leaders share information, protect the integrity of the group, maintain the group website, and facilitate meetings. They are also charismatic and keep the group motivated and focused. Without the leadership provided by the steering committee the Seniors Group would have disappeared long ago. (Casalegno, 2000)

f. Appropriate Etiquette

Users of the Blacksburg Electronic Village discussion groups are greeted by this rule on the web site before they select a discussion group:

> Users of news.bev.org who continually annoy or harrass other people, make regular use of foul language, or create any other problems that generate constant complaints, may be blocked from access. (www.bev.net)

Abusive behavior or "flaming" is highly frowned upon and is viewed as contrary to the goals of the BEV. This is not a big problem for the BEV. One member, however, did not understand that the use of all capital letters in an email is perceived as shouting in online communication. His response to another's post was written in all caps and caused some hurt feelings but after some education the misunderstanding was cleared up.

g. Events to Bind Members Together

The members of the BEV are held together by a common love of their hometown, Blacksburg. They take great pride in their community and believe that through the use of the network they can make the town an even better place to live. The BEV helps them to schedule regular in-person meetings at least once a month. The

enhanced communication has also created many new friendships and members use the network to help them plan individual social get-togethers. Members have said that the communication enabled by the BEV has given them a stronger sense of commitment to the community and to the group. (Casalegno, 2000)

h. Celebration of Rituals

Since the BEV doesn't really maintain profiles on its members there is no official recognition of special events in members' lives but members do recognize each other online. One member of the community tells a story about a long distance birthday gift delivered via the BEV. She remains in contact online with 25 women friends on a regular basis. On one recent birthday her sister, who lives across the country, ordered a pizza through the BEV homepage and had it delivered to her sister in Blacksburg with a happy birthday message from the deliveryman. (Casalegno, 2000)

i. Subgroups Within the Community

The "Community" page of the BEV website lists 14 categories of interest and each of those categories has numerous subcategories within them. However, these listings are not interactive. They only provide a bulletin board-like posting and some have links to a web page with specific information about that topic. The BEV has really been a facilitator for groups in the community to get their message out to others. To participate in a Blacksburg Electronic Village subgroup one must post a message to one of the 12 BEV-specific newsgroups or join one of the three mailing lists. Most of the subgroup web pages provide information regarding their meeting schedules as well as information about their group. (www.bev.net)

3. Usability Principles

The home page for the Blacksburg Electronic Village is very simple with current announcements in the center of the page and a clear menu of choices along the left margin. Clicking on the broad topics on the left side of the page displays more specific choices in the center of the page and the user "drills down" through the increasingly specific hyperlinks until reaching the desired information.

a. Users

Currently, over 87% of Blacksburg citizens are online. With a population of about 38,000 people there are a lot of different interests. It would be very difficult to cater to all of the possible interests in a group this large so the Blacksburg Electronic Village focuses on the town itself. The BEV was designed to be flexible enough to accommodate the many different needs of its users, from government forms to social clubs. Blacksburg citizens tend to be very proud of their town and this is the common binding thread between all members of the BEV. (Cohill, 2000)

b. Tasks

Members need to be able to find town-specific information so all of the links on the site are indexed into broad categories, which get more specific as the user "drills down" into them. To communicate with others members are given email accounts and then are free to contribute to any of the newsgroups and/or sign up for the mailing lists. All of these resources are available through the website. However, to view the newsgroups the user needs to have a separate piece of software called a newsreader. It would be better is these newsgroups were accessible through the website.

c. Software

Consistency – all pages on the site have the same layout and color scheme. The menu remains the same throughout the site and the page title changes appropriately indicating the current page. Drilling down through the index of links takes the user to a short listing for the business or club. If that listing has a hyperlink to the organization's website then clicking on that link takes the user off of the BEV and into another site altogether in the same window. Some sites, such as the one for the New River Rovers soccer team, are a part of the BEV.net but have a completely different look and it does not have a link to the BEV home page. Linking to this page directly would not enable the visitor to easily reach the hub of the community if he did not know it existed.

Simplicity – The BEV is very simple to navigate and there is a lot of links to helpful information. The main menu on the left side of the page has ten upper-level links and nine sub-links that do not change from page to page. One of those links is to

"Search Tools". This link takes the user to a page full of Internet searching resources as well as a link to search the BEV.

Universality – The Blacksburg Electronic Village website uses very simple HTML and colors with no fancy scripting. It appears in Netscape exactly the same way as it does in Internet Explorer, making it accessible to almost anyone with a computer and a browser who wants to join. This was very important in the design of the BEV since there were many people in the community that had only older computers and the designers of the BEV have always kept that in mind. (Cohill, 2001)

Predictability – The BEV is well organized and the words chosen for links are very clear. Clicking on them results in an easy to predict action. The only exception to this is clicking on an organization hyperlink will sometimes take the user away from the BEV and to another site altogether. Some organizational links take the user to a link within the BEV framework but the layout of the page that in no way resembled the layout of the main BEV site. Some of these sites did not even have links back to the BEV main site. A better design might be to open links to external sites in another window and to standardize some part of all pages within the bev.net framework.

C.   AMERICA ONLINE

Figure 3.   America Online Homepage.

America Online (AOL – www.aol.com) is one of the first computer based online communities dating back to the early 1980s. AOL is an Internet Service Provider (ISP) where members pay a monthly fee for access to the AOL network and to the Internet. The primary means for members to communicate is through email but AOL provides an additional service called "AOL Instant Messenger" where members can communicate with other members who are online at the same time.   Members can build their own web pages in the AOL Hometown. In an effort to become ubiquitous, AOL provides many different ways to connect to their service. AOLTV is a box that plugs into a television set providing access to many of AOL's features, including Instant Messaging, right on a television set. Instant AOL is a touch screen appliance that connects directly to the AOL website via a phone line. The AOL Mobile Communicator is a small wireless handheld device with a thumb-operated keypad that allows members to send and receive Instant Messages and email. The communication features of AOL can also be accessed from

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handheld computers, cell phones, and regular voice phones. Clearly, AOL is making every effort to become the ISP of choice for regular people who want to stay connected.

D.   EBAY

Figure 4.   eBay Homepage.

eBay (www.ebay.com) is a site built primarily for the buying and selling of just about anything. Registered members can bid on items up for sale or put merchandise up for sale by auction. But there is also a community side to eBay. There are forums and chat rooms for members to interact and these interactions are regulated by a simple set of rules called "Community Values". These values are published on the website for everyone to read. Upon logging in to the communication features of the site users are reminded that they are responsible for their own words. Users who have bought merchandise from them rate sellers and clicking on the seller's name reveals all the comments from other members who have purchased merchandise from that seller. This level of accountability encourages propriety in all transactions on eBay and gives members a sense of ownership by letting their voices be heard.
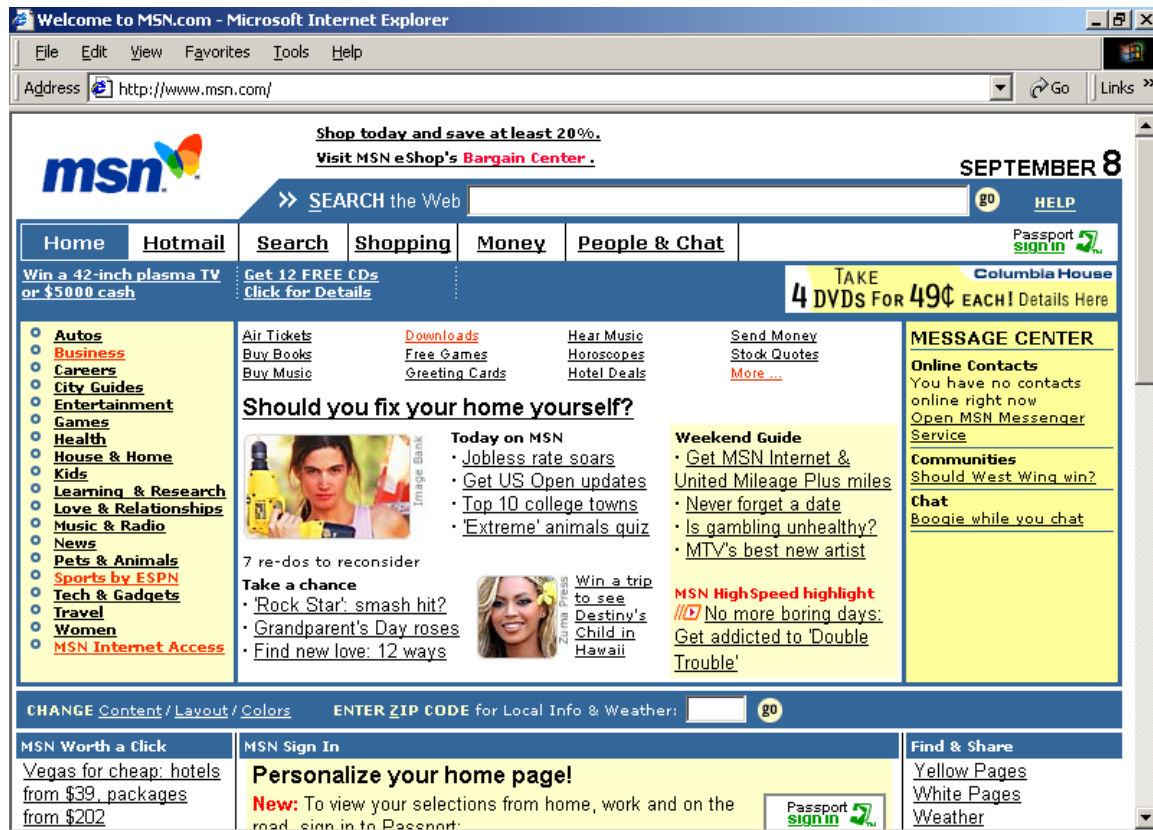
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E.   MICROSOFT NETWORK

Figure 5.   MSN Homepage.

The Microsoft Network (MSN – www.msn.com) homepage is the default home page for Microsoft's web browser, Internet Explorer and, as such, gets hit a lot every day. The home page is well organized and the content on it is kept current. It has many features necessary for a successful online community. There are many useful links to current news, shopping, and general information as well as links to special interest discussion groups and chat rooms. Anyone can browse the discussions but must login to post messages. Membership is free unless members use MSN as their Internet Service Provider. To become a member one needs to sign up for a free Hotmail account, which gives the user access to web-based email. Another MSN feature that contributes to the community's sociability is the MSN Messenger Service. This service allows users to create lists of other people who have MSN accounts. Users are notified when people on their list are online at the same time the user is online. When two or more users are simultaneously online they can send immediate messages to one another, similar to a private chat room.

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F. TALKCITY

Figure 6.   Talk City Homepage.

Talk City (www.talkcity.com) is an online community focused on sociability. There are chat rooms and discussion forums for members to interact. The site is well organized into four broad categories to help users quickly find a topic in which they are interested. Members can establish their own home page as well as their own chat room to conduct their own discussions with friends. Talk City does a good job of keeping content current and hosts regular discussions via specially designed chat rooms which are like a live forum. Talk City is a good place to meet up with friends but also has meeting places to meet new people that share similar interests.

	Purpose	Places	Profiles	Roles	Leadership	Etiquette	Events	Rituals	Subgroups
WELL	Social	Conferences, "Send" Messages, Real-World Parties	Editable by users	Conference Leaders, Directors, Members	Conference Leaders, Directors	"You own your own words"	Monthly real-world gatherings	Members recognize events in lives of others	Conferences
BEV	Government, Commercial, Education, Information, Social	Newsgroups, Listservs, Real-World Gatherings	Directory	Members	Steering Committee	Posted Rules	Real-world community events	Recognition of common community events	Topical newsgroups, member webpages
AOL	Commercial, Information, Social	Forums, Chat Rooms, Instant Messages	Editable by users	Members	N/A	Varies by group	Chat room guests	Recognition of common community events	AOL Hometown
EBay	Commercial	Forums, Chat Rooms	Comments posted by patrons	Buyers, Sellers	N/A	Community Values	Online training courses	Recognition of common community events	Merchandise organized by categories
MSN	Commercial, Information, Social	Forums, Chat Rooms, Messenger Service	Editable by users	Members	N/A	Varies by group	Celebrity chats	Recognition of common community events	Forums and chat rooms form subgroups
Talk City	Information, Social	Forums, Chat Rooms	Editable by users	Members, Hosts, Moderators	Group leaders	Varies by group	Guests and topical chats	Recognition of common community events	Forums and chat rooms form subgroups

Table 1.   Communities and Principles.

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IV. DEVELOPMENT OF AN ONLINE COMMUNITY

Figure 7.   PRESENCE-Lite Homepage.

A.   BACKGROUND

PRESENCE is a bi-monthly paper journal published by MIT Press for investigators of teleoperators and virtual environments. It is an academic journal and the articles contained within it are thoroughly peer-reviewed before they are published. The peer-review process can be very long and articles are sometimes published up to a year after they are written.

PRESENCE-Lite (www.presencelite.com) is a website conceived to complement PRESENCE by offering researchers and practitioners of virtual environment technologies a very fast way of publishing their work. The idea was to keep the content light and the review process short in order to bring pertinent work to the community more quickly than

can be done with traditional paper journals. Everything on PRESENCE-Lite is done electronically through a web browser.

A prototype of the website was put together in 1998, completely done in hypertext markup language (HTML). The project stalled before any functionality was built into the site. The author of this thesis joined the project in 2000 and built the required functionality into the website to accept articles for review, as well as other necessary functions outlined below. The site was ready for article submissions in June 2000.

To further enhance the site, many of the principles of online communities were applied to PRESENCE-Lite to facilitate the interaction between researchers. The details of the development process can be found in Appendices A and B. The following is an analysis of the principles of online communities as they were applied to PRESENCE-Lite.

B.   APPLICATION OF SOCIAL PRINCIPLES
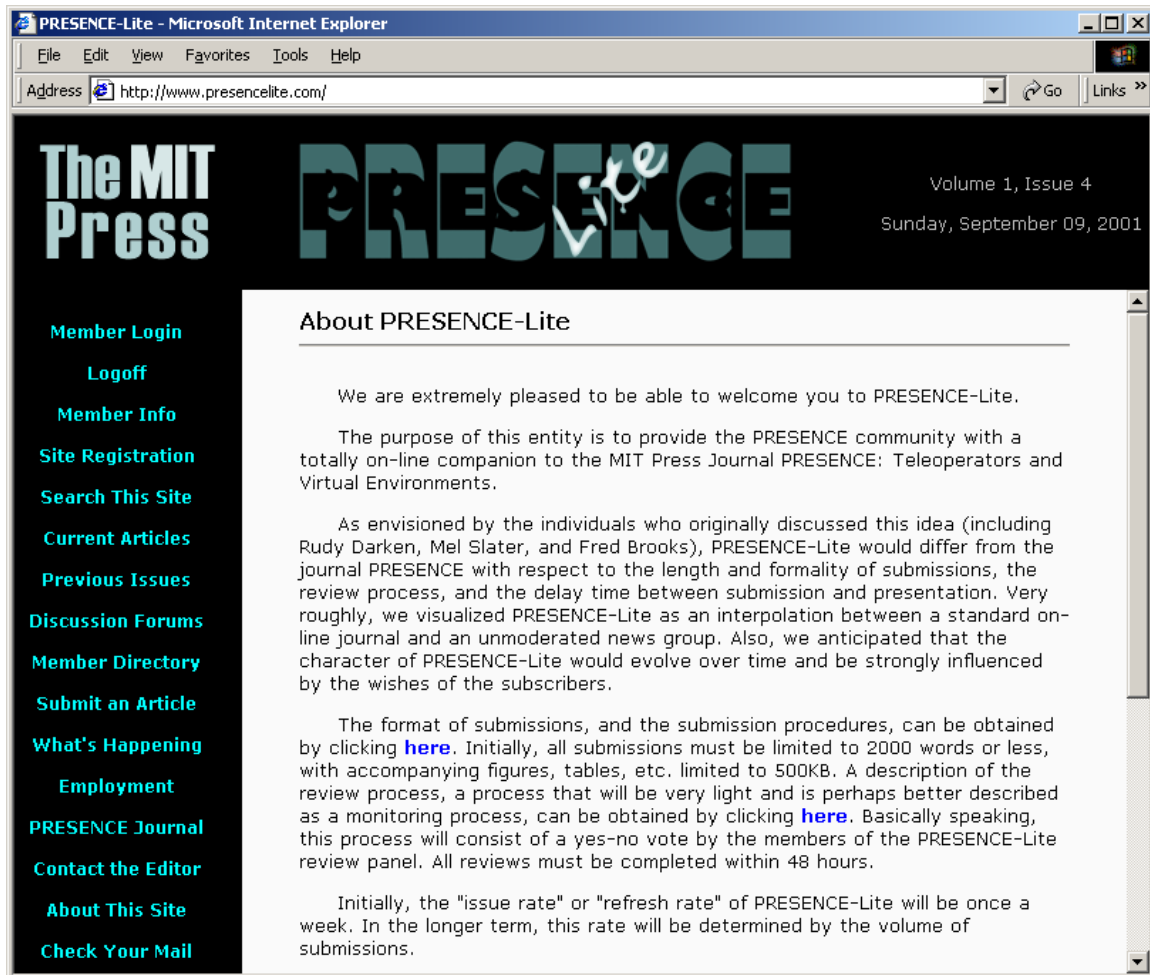
1. Purpose of the Community

Figure 8.   PRESENCE-Lite Information.

The purpose of PRESENCE-Lite is to provide researchers of teleoperators and virtual environments a place where they can publish their research very quickly making the site *the* place to go to find current research in this area. In addition to the peer-reviewed articles, the site is also meant to provide a place for members to meet with others interested in virtual environment technology to share ideas and make connections in an informal way.
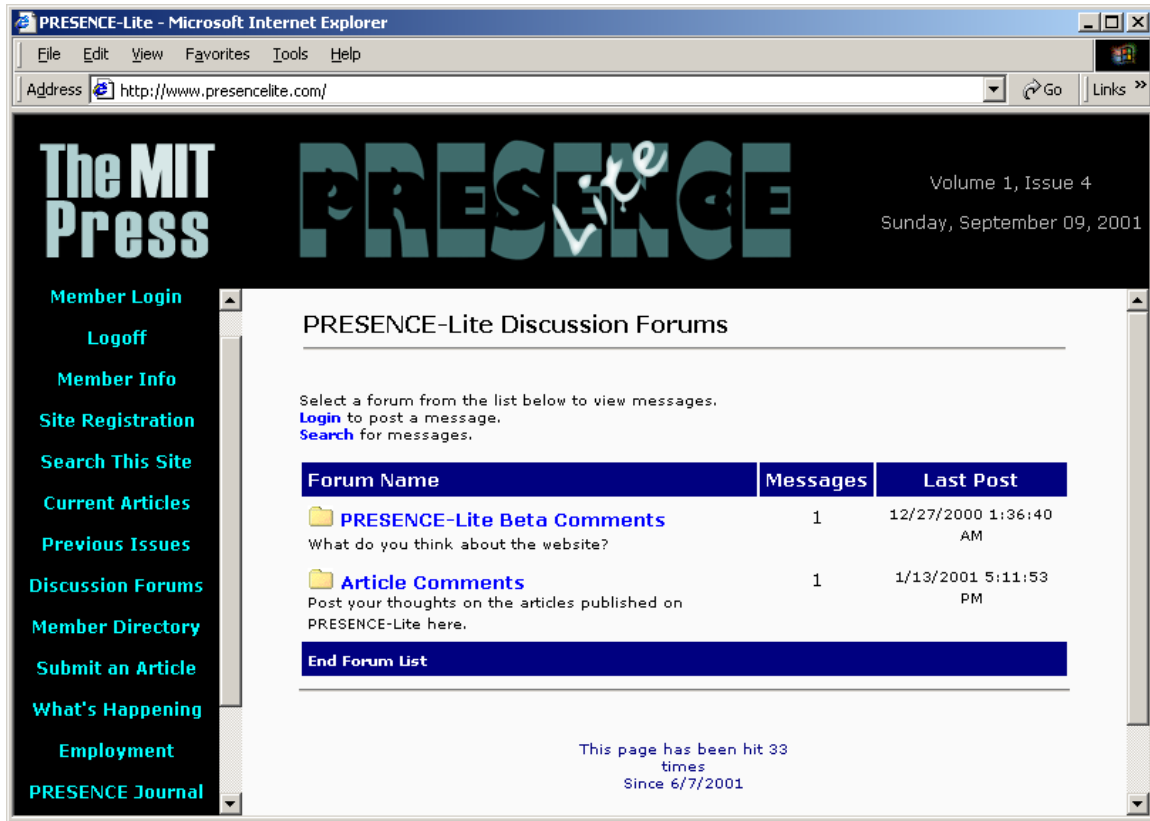
2. Places for Members to Gather

Figure 9.   PRESENCE-Lite Discussion Forum.

Currently the site has only a thread-based discussion forum on which members can interact with one another. There are plans to later implement a mailing list. Members can also post their email addresses in their profiles to allow other Members to contact them personally.

3. Persistent Member Profiles

Figure 10.   PRESENCE-Lite Member News and Profile.

All members of the community have profiles, which they are free to edit any time they like. The username that they select when they join the site is not editable and remains linked to the member's name for the duration of the membership. Each Member has a personal page on which all of that Member's profile information is shown in addition to the Member's article submission history. This history details the current status of all articles submitted by that Member. Each article is Pending, Accepted, or Rejected and is color-coded: yellow, green, or red, respectively.
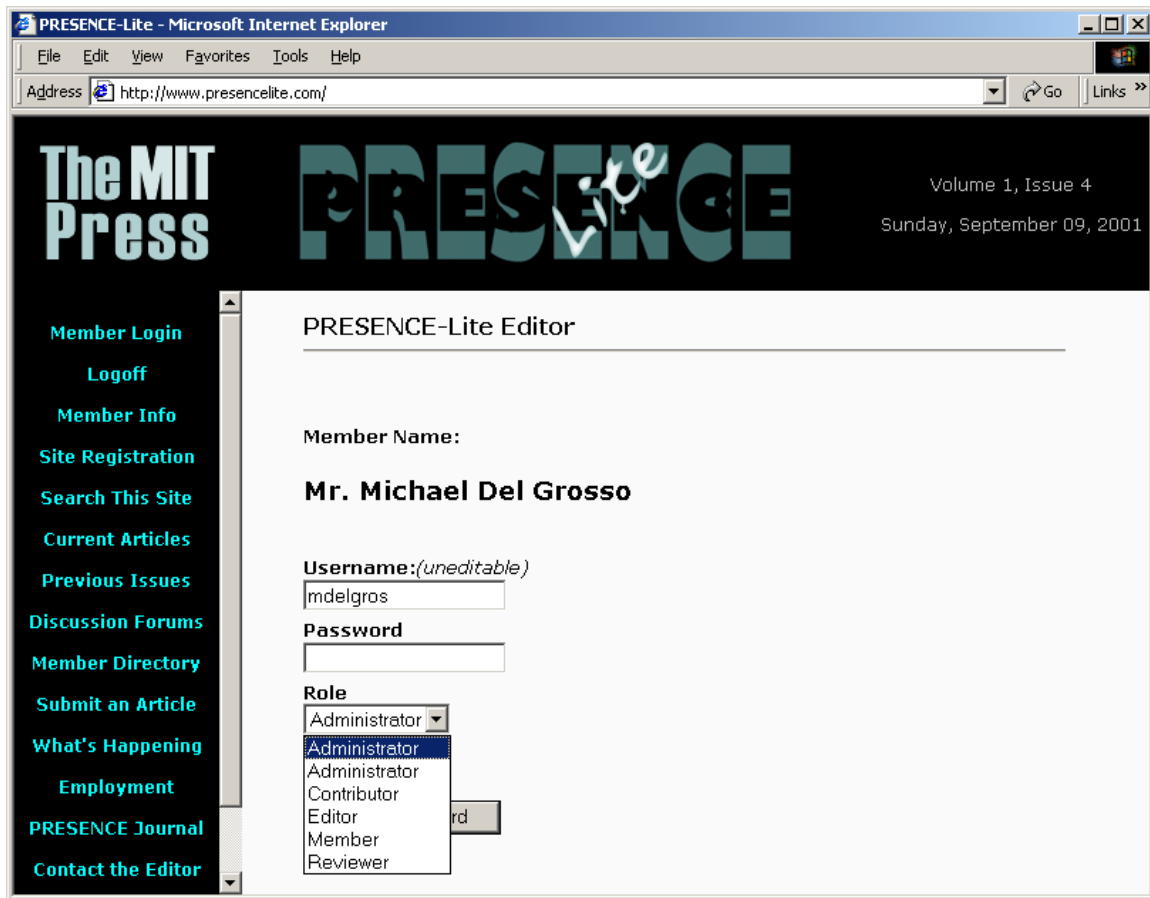
4. Member Roles in the Community

Figure 11. PRESENCE-Lite Member Roles.

There are six roles members can assume on PRESENCE-Lite: Visitor, Member, Contributor, Reviewer, Editor, and Administrator. Visitors are not formally recognized by the system but they have access to article abstracts and they can read comments submitted to the discussion forum. For a Visitor to read full articles and/or contribute to the community in any way he or she must register on the site to become a Member and login. Once a Member submits an article to the site and it is accepted then the Member's status is elevated to Contributor. The Editor has complete control over the content of the site and has the final say on all matters. At the Editor's discretion, certain Members and/or Contributors may be elevated to the role of Reviewer. Reviewers have a position of trust within the community and have more privilege. They have access to un-reviewed articles and it is their job to read these articles thoroughly and cast their vote as to whether the articles should be accepted or rejected. The Administrator has complete access to every part of the system to perform maintenance and upgrades.
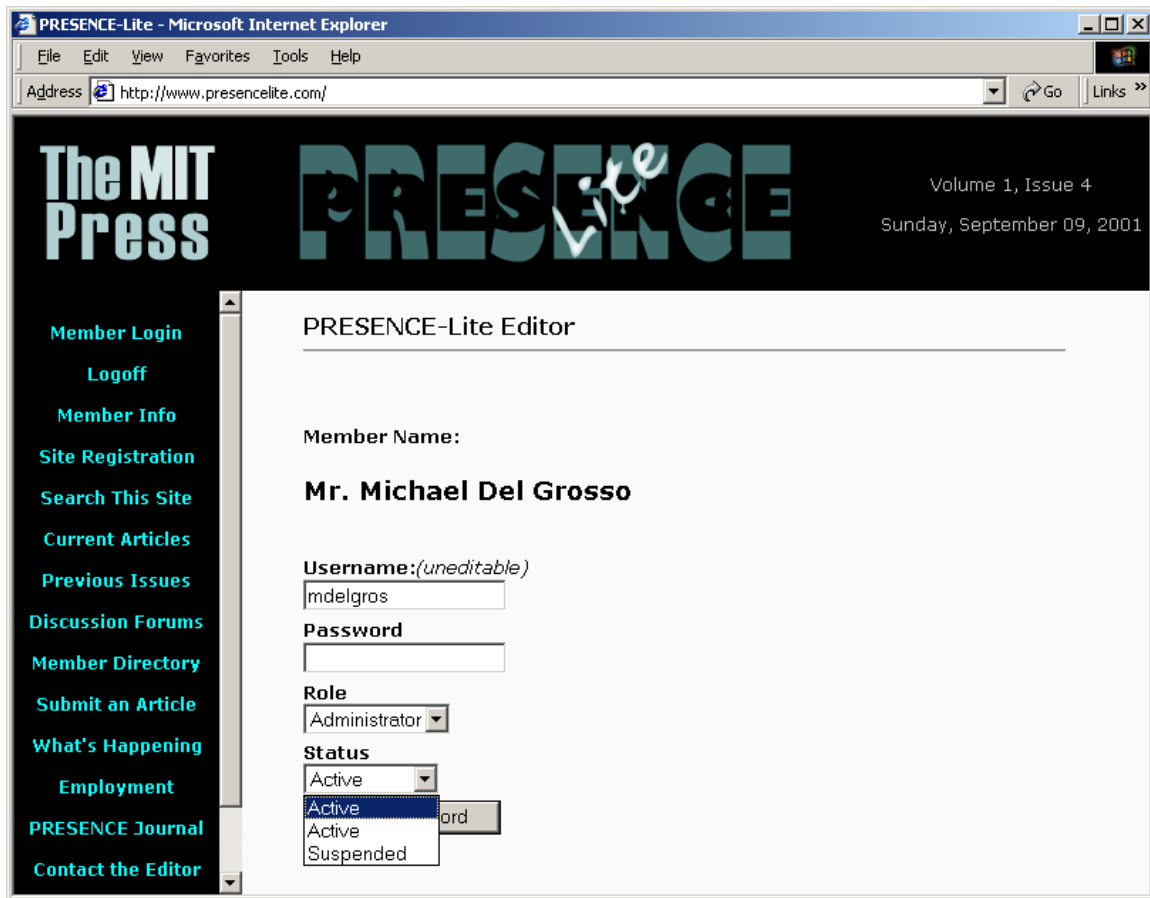
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5. Community Leadership

Figure 12.   PRESENCE-Lite Member Status.

The Editor is the overall leader of this community. He has the final say on everything that is posted to the site. He delegates authority to trusted Members whom he promotes to the role of Reviewer to screen all submitted articles for appropriateness. He also has the power to override decisions made by the Reviewers. Furthermore, he can demote members and even suspend membership if they fail to demonstrate appropriate behavior on the website.

6. Appropriate Etiquette

Although articles submitted to PRESENCE-Lite will be primarily academic and formal in nature, they will be less formal than those submitted to the parent journal, PRESENCE. They will still be peer-reviewed and appropriate to reference in other works. Article credibility is the key to the success of this site. The discussion forums are a less formal medium for members to post ideas and/or comments on posted articles or

just to meet others that share their interests. All of this is outlined in a letter from the editor posted on the website.

7. Events to Bind Members Together
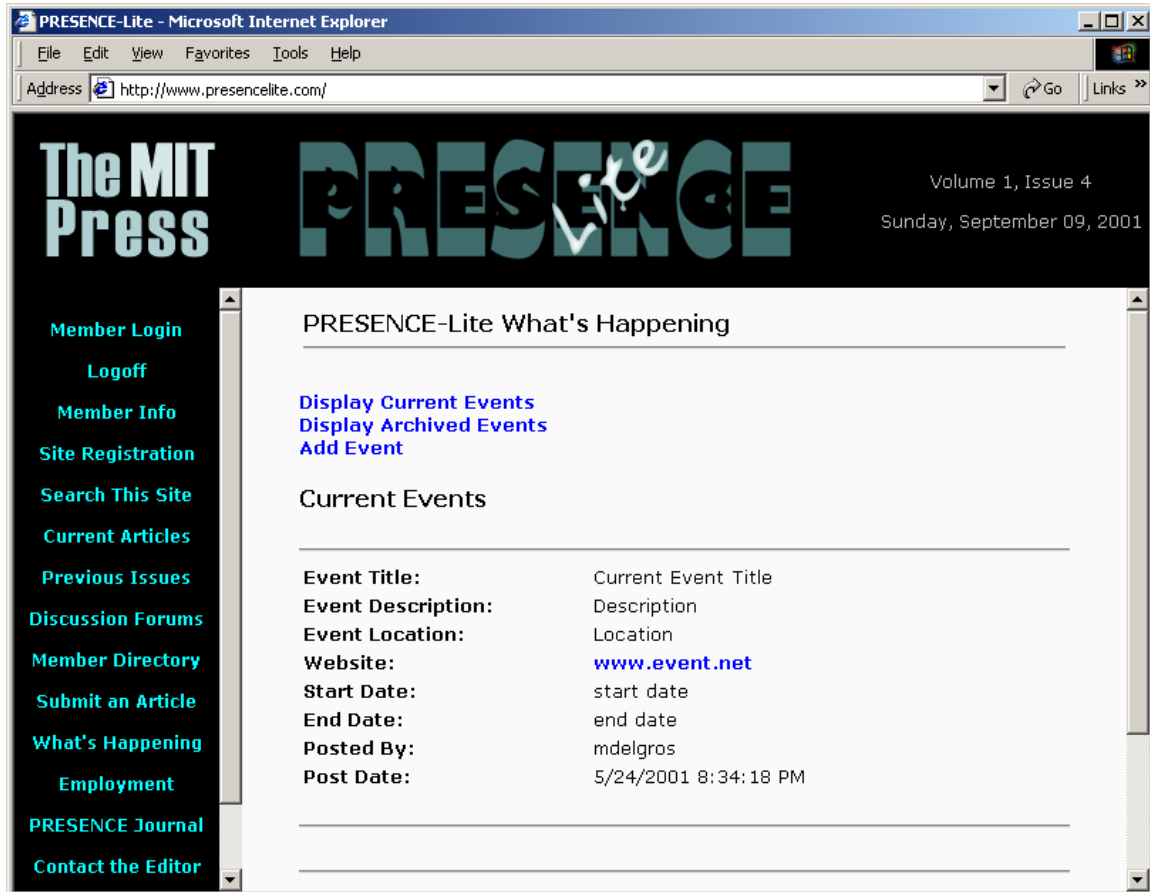
Figure 13.   PRESENCE-Lite What's Happening.

PRESENCE-Lite includes an area on the site called, "What's Happening" to announce upcoming events, such as conferences and calls for papers. Currently, there is no mechanism to support online events.

8. Celebration of Rituals

There are no rituals currently celebrated on the site but the date each Member joined the community is tracked. The Members' anniversary of joining can be recognized in the community newsletter.

9. Subgroups Within the Community

It is likely that subgroups will form later on in the evolution of PRESENCE-Lite but right now it is still in its infancy and consists only of one group.

C.   APPLICATION OF USABILITY PRINCIPLES

Usability was very important to the development of this site. A detailed usability study was done on the site and is included in this document as Appendix B.

1. Users

The target audience for the content of this website are researchers of teleoperators and virtual environments. Many of these users have been working with computers and virtual environments for many, many years. In spite of this extensive computer experience the site was designed to be as simple as possible. So from a usability perspective the site was designed for users familiar with a standard point-and-click website interface.

2. Tasks

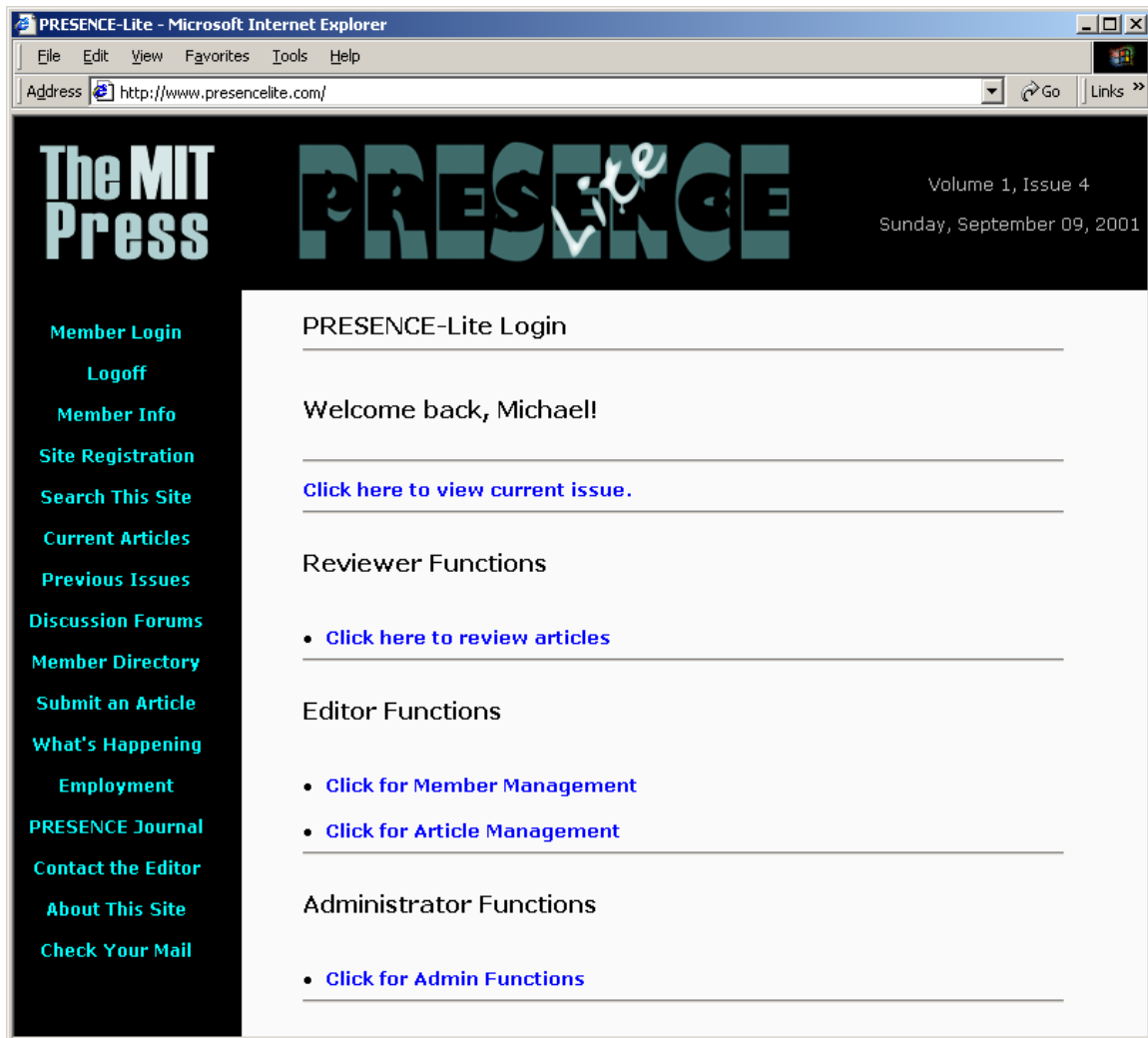Figure 14.   PRESENCE-Lite Administrator Login Page.

The tasks users will have to accomplish are role-dependent. There are six different roles for members of PRESENCE-Lite: Visitors, Members, Contributors, Reviewers, Editors, and Administrators.

Visitors will have to be able to search for keywords in article abstracts and in the discussion forums. The only other task for Visitors is to register on the site.
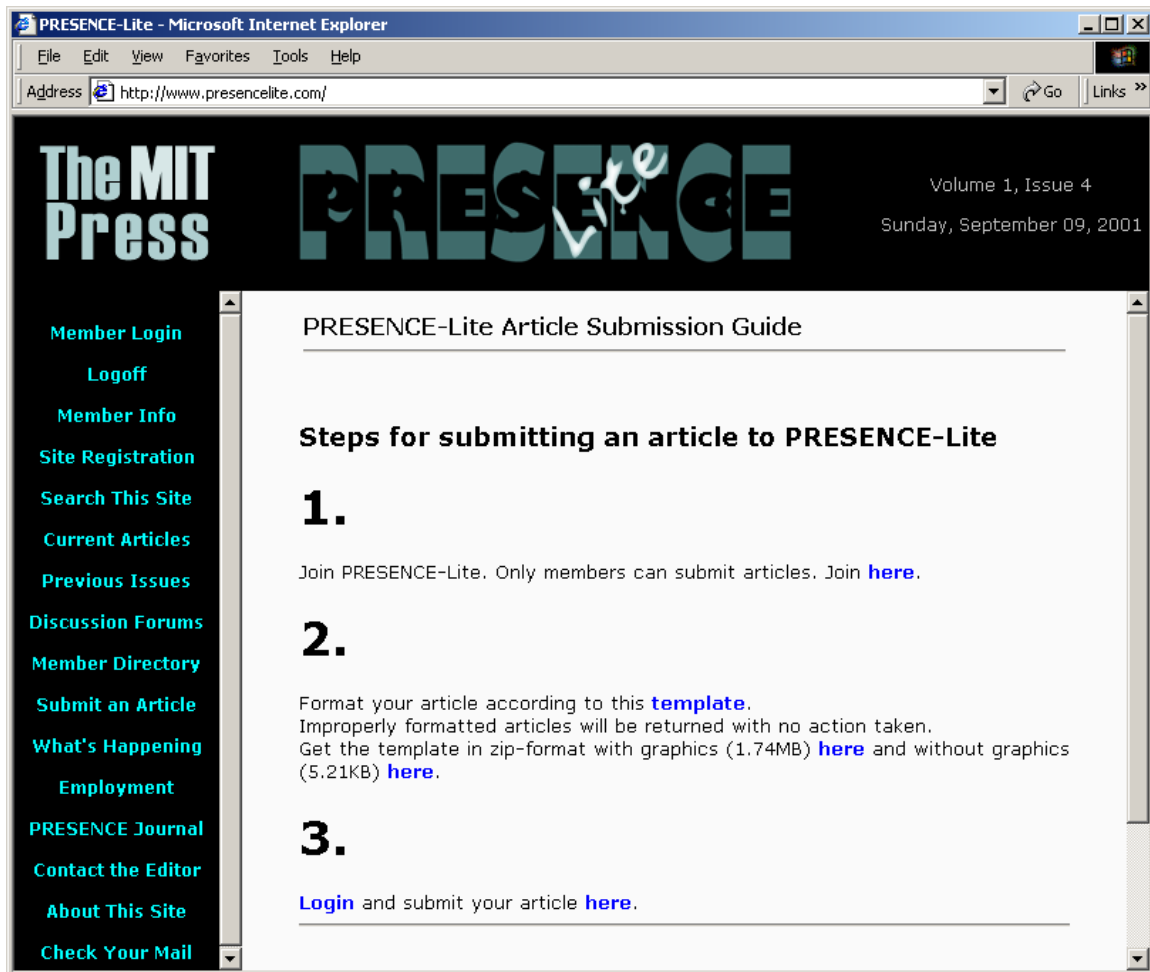
Figure 15.   PRESENCE-Lite Article Submission Instructions.

Members will be able to search for other Members as well as search the articles and forums for keywords. Members have the ability to post comments to the discussion forums, to submit articles for review, to post events to the "What's Happening" page, and to submit job opportunities to the "Employment" page. Members will also be able to update their own personal profile.

Figure 16.　　PRESENCE-Lite Member Profile Editor.

Contributors will be able to complete the same tasks as regular Members. They only have the distinction of being active contributors to the site.

Figure 17.   PRESENCE-Lite Article Submission Page.

Reviewers have the added ability to review new un-posted articles and cast their vote.   They have two choices: ACCEPT or DECLINE.   Once they read new articles Reviewers click one of these two choices and then are offered the opportunity to post comments regarding the article.
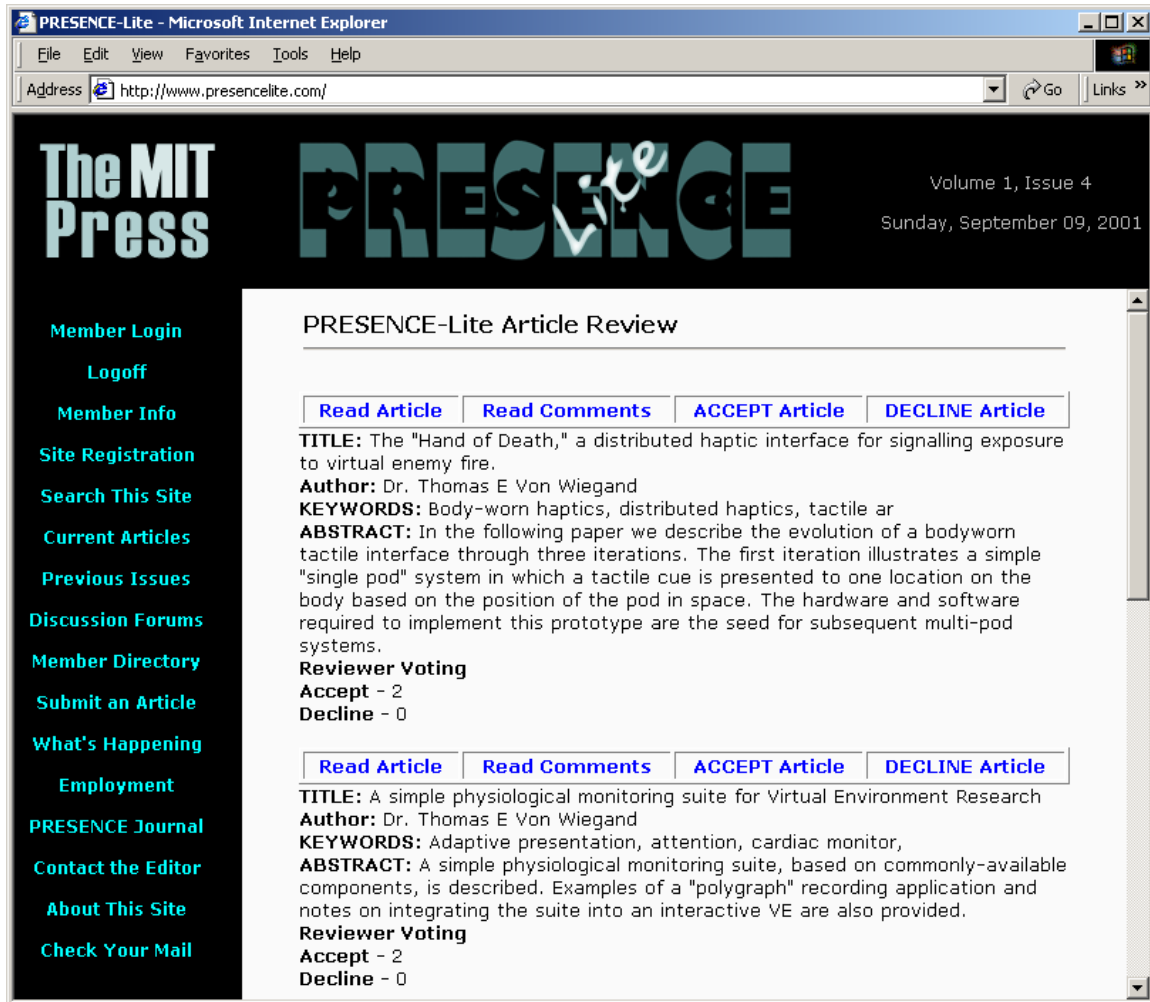
Figure 18.   PRESENCE-Lite Article Review.

Editors will be able to accomplish all of the tasks already outlined above for the other users. They will have complete control over who accesses the site and the material posted to it. So they will have the additional tasks of removing posted articles not deemed appropriate. They will also be able to promote and demote members by clicking on a Member's name and selecting their role from a drop-down list.

Figure 19.   PRESENCE-Lite Editor Functions (Member Management).
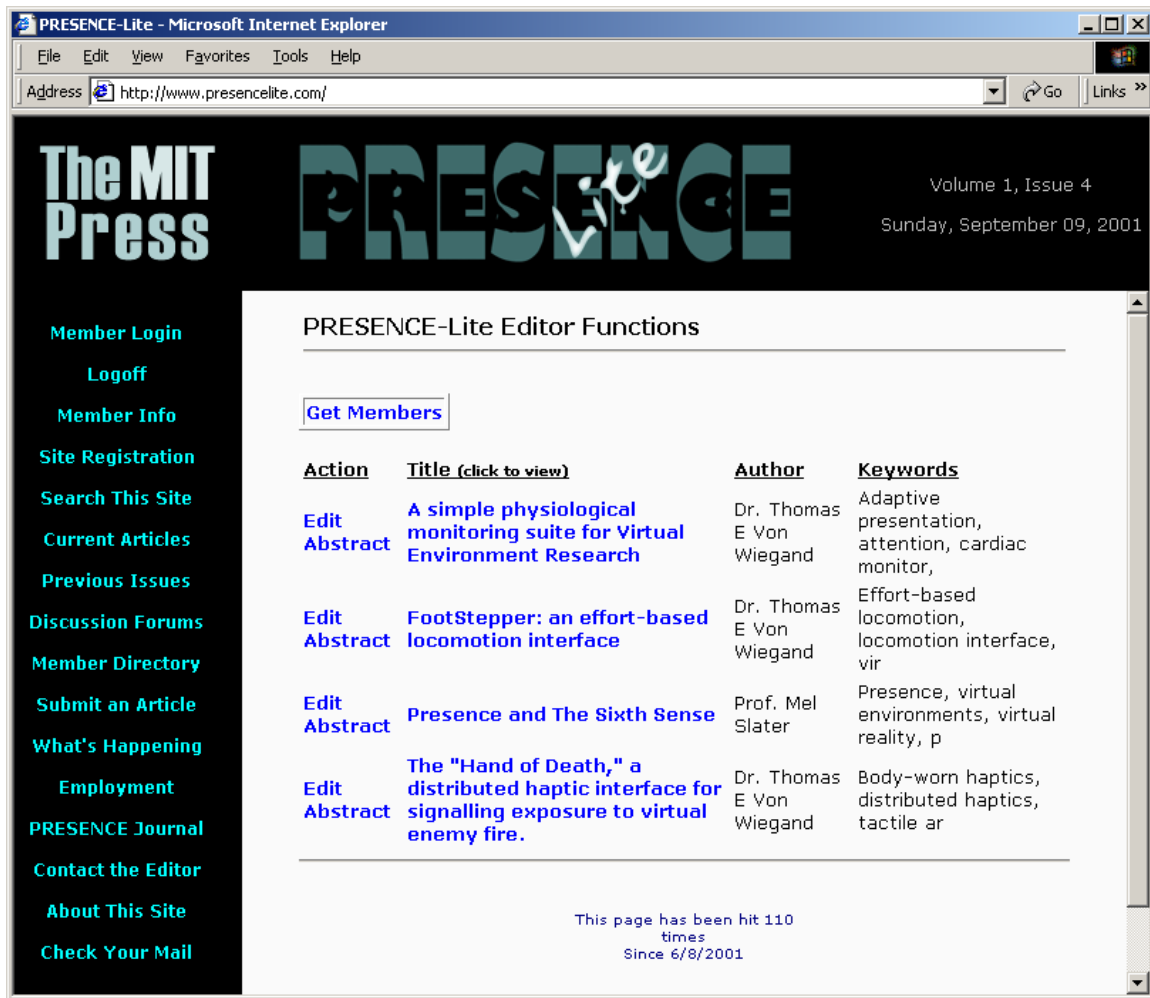
Figure 20.   PRESENCE-Lite Editor Functions (Article Management).

Administrators are responsible for system maintenance and have all of the access and options available to Editors. Administrators will be primarily responsible for correcting system errors and performing membership management, such as resetting forgotten passwords. They will also be responsible for implementing further enhancements to the system and keeping the hardware running efficiently.

Figure 21.   PRESENCE-Lite Editor Functions (Article Abstract Editor).

3. Software

a. *Consistency*
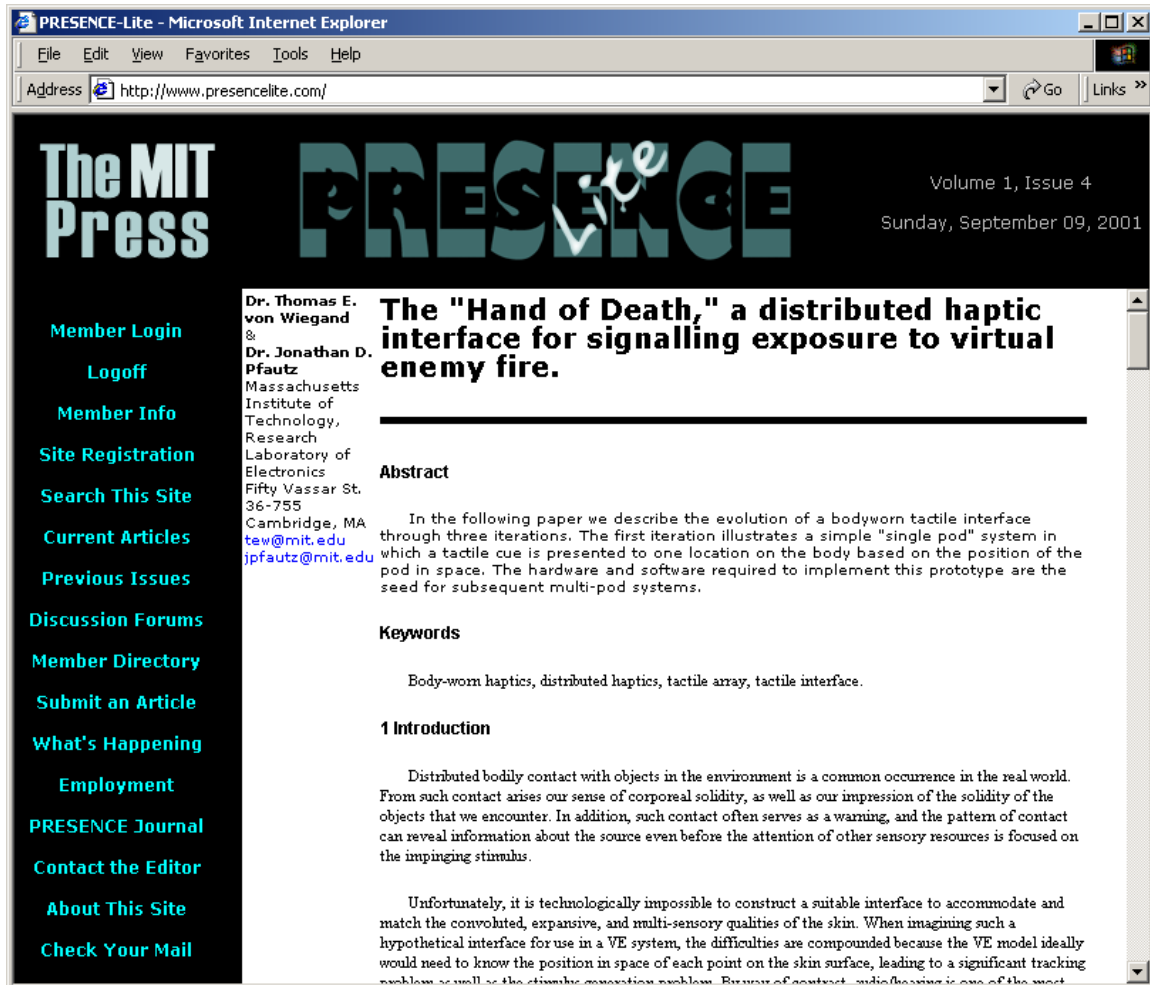
Figure 22.	PRESENCE-Lite Article Implementing Style Sheet.

To address consistency the site kept the original frameset layout from the prototype. The site logo is always visible at the top of every page and the navigation menu is always on the left side of the screen and is unchanging. All of the individual page layouts and fonts, including articles, are kept consistent through the use of Cascading Style Sheets. The usability study revealed instances where links to pages did not match the title displayed on the page. These inconsistencies were corrected to make the site comfortable for users.

b. *Simplicity*

Figure 23.   PRESENCE-Lite Registration showing drop-down.

Another argument for maintaining the original frameset was that it made navigating through the site very simple. All of the users' options are always visible on the left side of the screen and they are very clear. Every effort was also made to minimize the shifting of the users' hands from keyboard to mouse. Most operations can be accomplished using just the mouse. Drop-down selection boxes were implemented anywhere a finite number of textual choices were available, not only to show the user the available options but to keep the data contained in the database "clean".

c. *Universality*

The site works in all the current browsers available to users, although the implementation of the style sheet between them is inconsistent. This problem will have

to be addressed in the future. For a while the site would not even appear in some older browsers but then an error was found in the code for the frameset, correcting this problem. Even though the appearance of the site is different in different browsers the underlying functionality still works. At this point in development this was the most important thing.

d. *Predictability*
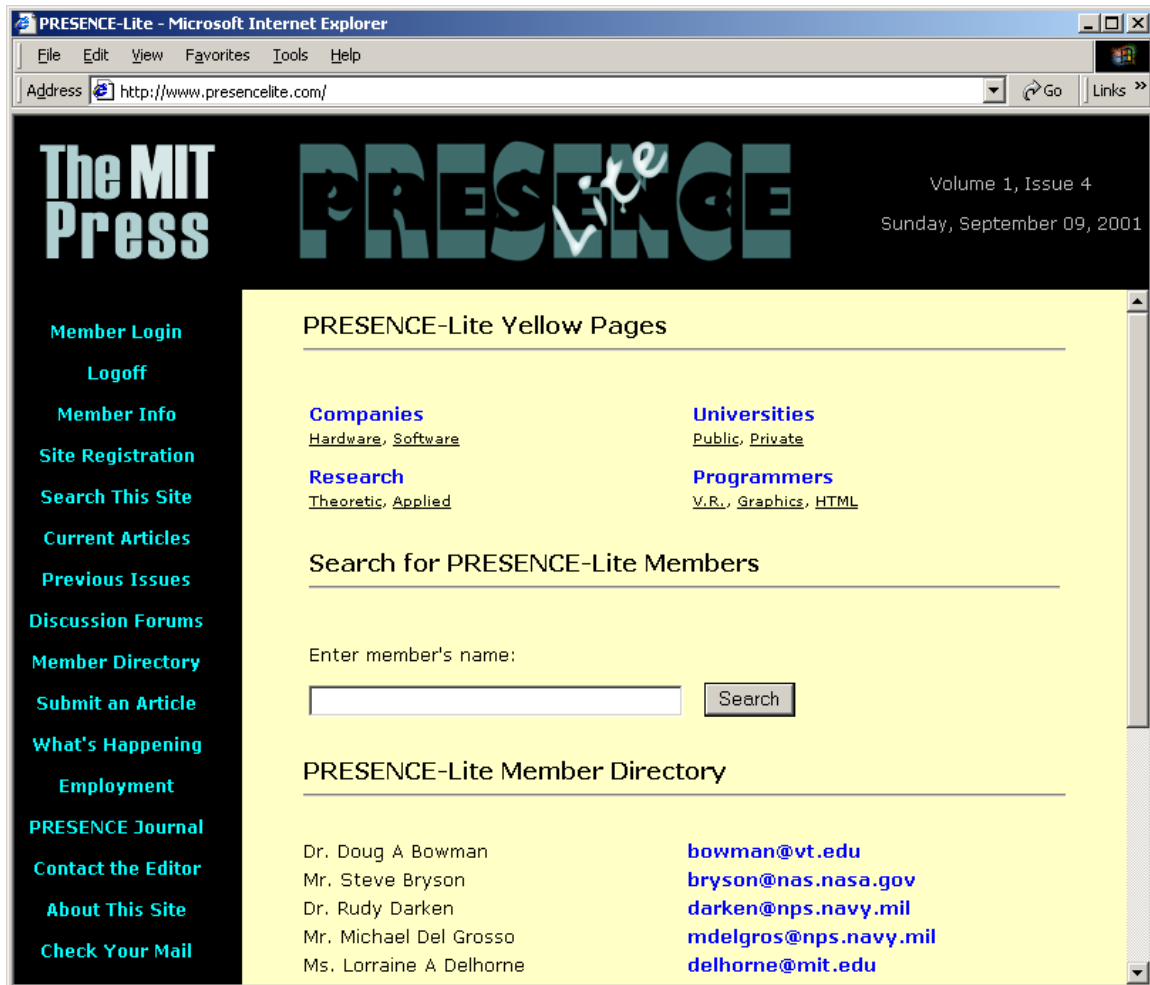
Figure 24.   PRESENCE-Lite Yellow Pages.

Every effort was made to make the site self-explanatory. Some ambiguous terms were identified in the usability study and changed to make them clearer. For example, the page listing all the members of the site was called "Yellow Pages". Testers were not sure what this meant and so it was changed to "Member Directory" to better reflect the information available on that particular page. All hyperlinks on the site

are made to stand out from surrounding text by making them a bold blue font that changes color when the cursor hovers over them.   Any links to sites outside of PRESENCE-Lite open up another window so the user can easily find his way back.

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V.   CONCLUSIONS

Every new technology that has come along in the past 150 years has promised to bring communities closer together. Boat canals, the railway system, the telegraph, telephones, and radios have all been presented as the silver bullet that would bring back the lost sense of community in the United States. Randy Connolly (2001) claims that we should blame Thomas Jefferson for our lack of community. Jefferson feared that if Americans coalesced into unvirtuous cities that the U.S. would become just like England. Jeffersonian Republicanism preached that for men to be truly free they must spread out and stake their claim to the land in order to preserve the republic. Americans have bought into this idea and have continually sought to distance themselves from one another. Technology was supposed to bring people together while still allowing them to remain geographically distant from one another. All of the technologies listed above failed to reinvigorate the lost sense of community and in fact contributed to its demise. (Connolly, 2001)

Well, here we are entering the 21st century and the next great technology, the Internet, is promising us a rebirth of American Community. Online communities are popping up everywhere. Businesses are tying the term to their websites in order to bring customers to their sites to buy their products. Many of these types of online communities are not communities at all but traps to lure people in and bombard them with targeted advertising. However, I believe that there are online communities that are able to bring people together, The WELL being one of the best examples. But, it is not a simple as putting a message board and a chat room on a website. It takes special people with a true desire to nurture community in people and a realization that it is not technology that will bring people together; it is people that will bring people together. Time will tell if the Internet will be able to make this happen. Online communities are not as good as real communities but for a geographically dispersed population it is the most promising technology-based community builder to come along in 150 years.

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LIST OF REFERENCES

Axelrod, R., *The Evolution of Cooperation*, New York: Basic Books, 1984.

Berners-Lee, T., *Weaving the Web*, HarperCollins, 1999.

Burkhalter, B., "Reading Race Online: Discovering Racial Identity in Usenet Discussions", Pp. 60-75 in *Communities in Cyberspace*, edited by Kollock, P. and Smith, M. A., Routledge, 1999.

Casalegno, F., "Community Dynamics and the BEV Senior Citizens Group", Pp. 99-121 in *Community Networks: Lessons from Blacksburg, Virginia*, Artech House, Inc., 2000.

Cohill, A. M., "Welcome to Blacksburg", Pp. 1-14 in *Community Networks: Lessons from Blacksburg, Virginia*, Artech House, Inc., 2000.

Connolly, R., "The Rise and Persistence of the Technological Community Ideal", Pp. 317-364 in *Online Communities: Commerce, Community Action, and the Virtual University*, edited by Werry, C. & Mowbray, M., Prentice Hall, 2001.

Donath, J. S., "Identity and Deception in the Virtual Community", Pp. 29-59 in *Communities in Cyberspace*, edited by Kollock, P. and Smith, M. A., Routledge, 1999.

Figallo, C., *Hosting Web Communities: Building Relationships, Increasing Customer Loyalty, and Maintaining a Competitive Edge*, John Wiley & Sons, Inc., 1998.

Godwin, M., "Nine Principles for Making Virtual Communities Work", *Wired*, 2.06, June 1994.

Hafner, K. & Lyon, M., *Where Wizards Stay Up Late: The Origins of the Internet*, Touchstone, 1996.

Hagel, J. & Armstrong, A., *Net Gain: Expanding Markets Through Virtual Communities*, Harvard Business School Press, 1997.

Heller, S., *Who's Afraid of C++?*, AP Professional, 1996.

Kim, A. J., *Community Building on the Web*, Peachpit Press, 2000.

Kolbert, E., "Pimps and Dragons," *The New Yorker*, May 28, 2001.

Kollock, P. & Smith, M., "Managing the Virtual Commons: Cooperation and Conflict in Computer Communities." Pp. 109-128 in *Computer-Mediated Communication: Linguistic, Social, and Cross-Cultural Perspectives*, edited by Susan Herring. Amsterdam: John Benjamins, 1996.

Kollock, P., "Design Principles for Online Communities," Harvard Conference on the Internet and Society, 1996.

Krug, S., *Don't Make Me Think! A Common Sense Approach to Web Usability*, Que, 2000.

Lewis, T. G., *Microsoft Rising…and other tales of Silicon Valley*, IEEE Computer Society, 1999.

O'Brien, J., "Writing in the Body: Gender (Re)production in Online Interaction", Pp. 76-106 in *Communities in Cyberspace*, edited by Kollock, P. and Smith, M. A., Routledge, 1999.

Oldenburg, R., *The Great Good Place*, Marlowe & Company, 1997.

Ostrom, E., *Governing the Commons: The Evolution of Institutions for Collective Action*, New York: Cambridge University Press, 1990.

Pearrow, M., *Web Site Usability Handbook*, Charles River Media, Inc., 2000.

Preece, J., *Online Communities: Designing Usability, Supporting Sociability*, John Wiley & Sons, LTD, 2000.

Rheingold, H., *The Virtual Community: Homesteading on the Electronic Frontier*, MIT Press, 2000.

Rossney, R., "Metaworlds", *Wired*, 4.06, June 1996.

Sagan, D., "Sex, Lies, and Cyberspace", *Wired*, 3.01, January 1995.

Standage, T., *The Victorian Internet,* Berkeley Books, 1998.

Werry, C., "Imagined Electronic Community: Representations of Online Community in Business Texts", Pp. 3-32 in *Online Communities: Commerce, Community Action, and the Virtual University*, edited by Werry, C. & Mowbray, M., Prentice Hall, 2001.

APPENDIX A. PRESENCE-LITE SOFTWARE REQUIREMENTS SPECIFICATION

A. INTRODUCTION

1. Purpose

The purpose of this Software Requirements Specification (SRS) is to define the requirements for the "Presence" magazine website. It will also allow for the development of use cases, tables, and diagrams that describe the functionality of the website.

2. Scope

The SRS supports the development of the "Presence" website which will automatically display journal articles that are approved by a panel of refers (Presence board members) to approved website-registered members.

3. References

The project will be developed use Software Engineering practices, concepts, and tools.

IEEE Standard for Software Project Management Plan, IEEE 1058.1:1987.

Peters, James F and Pedrycz, Witold, Software Engineering: An Engineering Approach, John Wiley & Sons, 2000.

Fowler, Martin, UML Distilled: A brief Guide to the Standard Object Modeling Language, Addison-Wesley, January 2000.

B. OVERVIEW

The SRS provides information concerning the requirements and proposed functionality of the "PRESENCE-Lite" website.

1. Product Perspective

The PRESENCE-Lite website is an interactive tool for web-based journal publications dealing with virtual environments and technology. The website will make reviewed-approved articles available to registered members within a week from the time of its approval.

2. Product Functions

The PRESENCE-Lite website provides approved-journal articles pertaining to virtual environments and technology to registered members of the website. It will allow members to view abstracts of articles, click on the abstract to view full article, submit articles for publication, use the yellow pages to locate other members, or go to other links of similar interest.

3. User Characteristics

PRESENCE-Lite is focused primarily to the same community as readers of Presence Journal, devoted to the advancement and research of virtual environment technologies. There are a couple types of users with characteristics that increase with their activity. From the strict user side, there are subscribed users, un-subscribed users, and browsers (people that just happen to come to the page). As this sight is devoted to serious, scholarly interaction, the knowledge base of virtual environments and the different terminology will be very useful although not absolutely necessary. Each one of these users must be familiar with operating in a frame environment of web pages. They must also be knowledgeable with highlight and click activity within the web environment. The key to this user's success is his ability to maneuver through web pages with the mouse. The second user type who inherits all the needed user properties from the first is the subscribed user who is also an author. This individual will need to know how to utilize FTP (File Transport Protocol) and/or e-mail attachments in order to upload their proposed article. The next type of user from the internal design side is the reviewer who also inherits all required traits but also must be comfortable with cutting and pasting material from and to the web. They may have to directly update information that they post to the web site and ensure that their information is current. This will

require some training that may be done by CBT (computer based training), which will be provided to each of the reviewers.

4. Constraints

- This web interface must be completely interactive, with no "dead" links.
- PRESENCE-Lite must maintain a level of serious and scholarly material and not be reduced to just another newsgroup or chat room.
- The web page should be fluid and material the user desires should be readily available with out much effort. This page should not be convoluted and busy.
- There must be a way to partition the subscriber view from the un-subscriber view.
- Should be accessible by all frame capable web browsers and if accessing from a non-frame capable browser, the user should have the ability to view in text format.
- Submissions must be allowed in electronic formats including, HTML, Java, QuickTime or MPEG.
- Each article that is accepted must be archived to a permanent web address, to enable searches on keywords, authors or titles.
- There should be no "dead" links on underlying pages not under the control of PRESENCE-Lite. The Yellow Pages must run regular check for broken links and try to repair, remove or flag as "not available at this time".
- Must be a way to remind those reviewers who have not submitted their vote on articles, to please comply within a given time frame.
- This site must be completed automated with little to no involvement from web designers.

5. Assumptions and Dependencies

Assumptions:

- Hardware requirements will be met
- Platform will be Windows NT/SQL Server based
- Site will be accessed fewer than 1000 times per week
- There will be no fees involved with registering on this site
- Submissions will be text-based only

Dependencies:

- Use of other than Windows NT/SQL Server will significantly delay production
- Inadequate hardware will not support system

C.   APPORTIONING OF REQUIREMENTS

1. Future Requirements

- Porting of system to Linux/Apache Server configuration
- Creation of mirror site suitable for download to handheld devices
- Extending content to support multimedia submissions
- Submissions and review will be linked and completely automated

2. Interface Requirements

- The interface for the PRESENCE-Lite web site requires only a computer with browser software installed that has access to the Internet.
- User Interface - The user interface will be a web browser (Internet Explorer or Netscape Navigator).
- Hardware Interface - A computer, with a pointing device, connected to the Internet.
- Software Interface - A web browser with Internet access and a text editor for preparation of HTML and ASP web pages.
- Communication Interfaces - Internet access via LAN or dial-in modem.

3. Functional Requirements

Information Flows - Data will predominately flow from the web site to the user. The user will log in to the web site and view material posted there. In the case of an article submission data will flow from the user to the web site. The user will submit an article to the web site for review and possible posting. Reviewers will access potential articles, review them, and determine whether or not they will be posted.

Process Description

```
Process Name:  New User
Input membership request found on website;
if all required fields are completed on form
{
Receive User Name used to access site;
}
else
{
     Prompt user to complete invalid fields until complete
or user terminates session;
}

Process Name:  Login
Input user name and password when prompted;
```

```
if user name/password combination is valid
{
      Allow user to access site;
}
else
{
      Notify user of incorrect login attempt;
      Redisplay login screen;
      Offer user option to have password emailed to him;
}
```

Process Name: Article Submission
```
Member uploads article for consideration;
If majority of reviewers approve article
{
      Post article to web site with comments;
      Assign article unique Uniform Resource Locator (URL);
}
else
{
      Return article to author with comments;
      Delete article from system;
}
```

4. Data Construct Specification

- **Members** = {MBR_ID, USR_NAME, FIRST_NAME, MID_INIT, LAST_NAME, ADDRESS, CITY, STATE, ZIP_CODE, EMAIL_ADDRESS, WEB_SITE, DATE_JOINED}
- **Articles** = {ART_ID, TITLE, ABSTRACT, ARTICLE_TEXT, MBR_ID, SUB_DATE, URL}
- **Reviewers** = {REV_ID, LAST_NAME, FIRST_NAME, EMAIL}

5. Data Dictionary

Name	Type	About	Life Span
	Data Flows		
Member	Tuple Read/Submit	End user	Indef
MBR_ID	Unique Number	Id Number	Indef
USR_NAME	Text	Login Name	Indef
FIRST_NAME	Text		Indef
MID_INIT	Text		Indef
LAST_NAME	Text		Indef
ADDRESS	Text		Indef
CITY	Text		Indef
STATE	Text		Indef
ZIP_CODE	Text		Indef
EMAIL_ADDRESS	Text		Indef
WEB_SITE	Text		Indef
DATE_JOINED	Date		Indef
Articles	Tuple Post/Read	Site Product	Indef

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ART_ID	Unique Number	Id Number	Indef
TITLE	Text		Indef
ABSTRACT	Text		Indef
ARTICLE_TEXT	Text		Indef
MBR_ID	Text		Indef
SUB_DATE	Date		Indef
URL	Text		Indef
Reviewers	Tuple	Review Panel Post/Reject	Indef
REV_ID	Unique Number	Id Number	Indef
LAST_NAME	Text		Indef
FIRST_NAME	Text		Indef
EMAIL	Text		Indef

6. Performance Requirements

- Static – The web site will support approximately 100 users per day for viewing articles.
- Dynamic – Each page within the site should be viewable within 2 seconds of being requested from dialed in user.
- Static – The web server will have 128 megabytes of RAM.

7. Logical Database Requirements

- Member information will be maintained in a database.
- Access data will be authenticated against database records.
- All posted articles will be permanently archived and accessible via its own unique URL.
- Reviewer information will be maintained in the database along with voting information on articles.

8. Design Constraints

Users are responsible for their actions within this environment. With PRESENCE-Lite being the informal, interactive, fast response time vehicle for communication among the members of the virtual environment technologies community, users must adhere to rules governing the content of material to be discussed and submitted for publication. Assumption being made is that subscribed users will hold themselves more accountable for their actions within this environment therefore producing more credible and useful discussions. For future references, the idea of having a paid subscriber somewhat guarantees that those subscribed are of a certain age (although not an absolute indicator) and level of maturity and serious about the subjects being presented.

Reviewers are responsible for making unbiased judgments on material being reviewed for publishing. Judging must also be done within the time constraints given.

This site must be interesting enough that it draws users in to become paid subscribers and give them a feeling of belonging to a special group made of scholars and "out of the box" thinkers that may impact the world of virtual environment technologies.

Feedback is critical to the life of this site. It is imperative to receive useful input on the needs and desires of the people within the community and have a quick turn around response to those needs and desires.

The site will be governed by the editors of PRESENCE-Lite and assisted by a team of webmasters.

9. Software System Attributes

Reliability - The system will be built to stay on-line for 24 hours, seven days a week, 365 days a year. Initial use of a DSL line for network capabilities will be implemented. A backup server with mirrored information will be automatically placed on line if any problems should arise with the primary server. A Digital Subscriber Line is one of the most noise free lines available in industry today.

Security - Initial security will comprise of Norton Anti-Virus 2000 software and Norton Internet Security 2000 firewall and protection software. Norton is used throughout the DoD in protection of their systems and is recommended because of their progressive updates and ease of use. A firewall makes decisions on whether or not to allow data to pass based upon a security policy. For each packet of data, the firewall compares known components of the packet to a security rule set and decides if the packet should be allowed to pass. Norton Internet Security 2000 offers the ability to define specific security policies and monitor all network activities from one simplified user interface. Norton Internet Security 2000 supports all IP protocols and services including streaming media for e-commerce.

Maintainability - The system will be designed completely from COTS (commercial off the shelf) technology. The system will include complete and detailed documentation of every facet of the system. This will eventually be a turnkey system, in

which the operators will run and maintain. Training will be provided in CBT or on-line form in order for this system to be turned over. With the use of COTS, upgrades and replacements will be readily available.

Portability - All COTS with minor programming involved. Use of COTS allows for immediate and complete portability to like systems.

D.   EXPANDED USE CASES

1. Submit Article

1. Login
2. Select "Submit Article" from Menu
3. Download Article
4. Verify by Size (Bits/Bytes) to user successful download
5. Give user estimation of when he/she will be notified
6. User exits subsystem
Alternate: Authorization failure
At step 3 system fails to download article
Prompt user to retry submission process
A second failure
Prompt user to email article to webmaster
Alternate options
6.a. User selects an abstract, user downloads article

2. Use Yellow Pages

1. Login
2. User selects "Member Directory"
3. User locates a member (Email address)
4. User sends located member an email
5. User exits system
Alternate authorization failure
Email fails – Retry
Alternate Options
5.a. User selects abstract
5.b. User submits article
5.c. User goes to new site

3. View Article

1. Login
2. Customer browses abstract articles
3. Customer selects an abstract
4. Entire article is displayed to customer (Abstract Selected)

5. Customer selects options at the end of reading the article
6. Customer exits system
Alternate: New Customer
1.a. Customer inputs personal phrase to recover password
Alternate: Authorization Failure
At step 1, system fails to login the customer
Alternate: Options
5.a. Customer returns to view abstracts
Customer downloads article
Customer exits system

4. **Board Member Votes**

1. Board members submit their votes
2. Majority "yes", place article on web-site
3. Majority "no", return article to author
4. All comments forwarded to author

5. **Go to New Site**

1. User selects a link from the menu
2. User goes to another web site
Alternate: New Customer
1.a. User login
User selects a link from the menu
User goes to new website
User logs out
Alternate: Authorization failure
At step 2, system fails to establish a path to new link
System does not logout user
Retry

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APPENDIX B. PRESENCE-LITE USABILITY TEST

E. PROBLEM DEFINITION

1. What Activity Will The System Support?

This system will be a web site that facilitates the review and publication of special-interest articles.

2. Who Will Use It?

Any group that wants to gain or share knowledge in their particular area of interest on the web will use this site.

3. Under What Criteria Will The System Be Judged?

Ease of use will be the primary gage for success of this product. We will ask potential users to use the site and test its features in three roles: user, reviewer, and administrator. If a user unfamiliar with the site can accomplish tasks without training in each of these rolls then we were successful.

4. How Will The Problem Be Approached?

We will look at the generic problem of automating the publication of on-line articles so the results of the usability test can be used with any type of on-line publication. Then we will ask potential users to test it.

5. Problem Statement:

Up to date, credible articles currently cannot be reviewed and published in a timely manner using traditional paper journals.

Our goal is to create a web site that will automate the publishing of reviewed and credible articles that have been scrutinized by an expert in a particular field.

F.   REQUIREMENTS GATHERING

1. Needs Analysis

Situation of Concern - Currently there is no way to publish credible and meaningful articles in a timely manner.

Goal - Develop an interactive means of sharing and communicating new and innovative ideas in an electronic form for a technical community in a timely fashion.

Activity - Read, submit, review and comment on articles within a certain technical community.

Features - Read, post, review, comment on articles, search for specific topics, register users, provide non-member level access (abstract posting), search for members, notify contributors of article submission acceptance or rejection, provide reviewers an automatic notification of article submission, and provide user community (e-mail, profile personalization).

2. User Analysis

User Characteristics

- What will this site be used for?
  - Intellectual and professional enrichment
  - Tool for gathering research in a specific technical area
- How often will the site be used?
  - Daily

Skills Required

- General User
  - Internet browser experience
  - GUI interface experience
  - Domain Knowledge
  - Flat lined learning curve
- Reviewer (inclusive of general user knowledge)
  - Word processing experience
  - Ability to save documents in html format
  - Familiar with download and upload procedures

User Analysis Conclusions

- The site will be best viewed with Internet Explorer 5.0 or greater or Netscape 6.0 or greater.
- The following error handling procedures will need to be implemented:
    - Required fields must be filled in
    - Must be a member to upload and browse entire space
    - Non-members are directed to the sign-in page

3. Task Analysis

The current system operates as follows: A proposed writer uses a typewriter or word processor to type an article. He then sends a hard copy of this article to the journal via the mail or other delivery system. The journal sends the article through the publication "triage" to decide who should review it for publication. The article is received, reviewed, and approved or disapproved by the reviewer(s). The reviewer(s) comment on the article and forward the comments back to the journal. The journal, if the article is approved, typesets and publishes the article or sends rejection notice, with comments, to the author. Readers wait quarterly for article to be published.

G.   DESIGN

The goal of the design stage is to complete a conceptual and visual design of the system based on the requirements specification.

1. Conceptual Design

Develop the conceptual model for the application including all:

- Objects
- Attributes of objects
- Relationships between objects
- Actions on objects
- Actions on attributes
- Actions on relationships

2. Visual Design (Initial scenario design)

Sketch the screens that are needed for the design. Based on the functionality outlined in the task analysis and the function points in the conceptual design, determine how this functionality will be accessed (via menus, buttons, dialog boxes, etc.).

3. Early Analysis

Show your sketches to two outside reviewers unfamiliar with your project. Walk them through a few tasks to get some initial feedback as to the efficacy of your design.

4. Conceptual Design

Objects

- Articles
- Members
- Visitors
- Reviewer
- Abstract
- Administrator
- Links
- Directory
- Files
- Database
- Archive
- Keyword
- Reviews

Relations

- Article has an abstract
- Directory has an article
- Article has 1 or more files
- Article has 1 reviewer
- Article has 1 member
- Database has members, articles, abstracts, directories, links, reviewers, administrators
- Articles have 1 or more keywords
- Reviewer is a member
- Articles have reviews
- Admin is a member

Actions on Objects

- Articles
  - Post
  - Review
  - Delete
  - Read

- Members
  - Add
  - Delete
  - Update
  - Validate
  - Authenticate
- Links
  - Add
  - Delete
  - Update
- Reviewer
  - Validate
  - Add
  - Delete
- Abstract
  - Post
  - Review
  - Delete
- Administrator
  - Validate
  - Add
  - Delete
- Directory
  - Add
  - Delete
  - Update
- Database
  - Update
  - Archive
  - Add
  - Delete
- Files
  - Add
  - Delete
  - Update
- Reviews
  - Submit
  - Posted
- Keyword
  - Added

Actions on Attributes

- Articles
  - Status updated

- Member/ID
  - Added
  - Email provided
  - Add
  - Phone update
- Links/URL
  - Edit/update
- Directory/Name
  - Created
- Database/Data
  - Added
- Directory/Date
  - Assigned
- Files/Name
  - Created
  - Date assigned

Actions on Relationships

- Articles/Abstract
  - Created by author
- Directory/Article
  - Assigned
- Article/Files
  - Assigned
- Article/Reviewers
  - Chosen
- Article/Member
  - Submitted
- Database/*.*
  - Edit
- Articles/keyword
  - Assigned
- Reviewer/Member
  - Assigned
- Articles/Reviews
  - Submitted
- Administrator/Member
  - Assigned

5. Visual Design

This consists of handwritten sketches of the proposed design. These have been omitted to conserve space.

H.   USABILITY ANALYSIS

1. Tasks

The following list of tasks was given to each subject and they were timed for completion of each task.

- Read abstract from current issue
- Read abstract from October 2000 issue
- Register yourself on the site
- Update your member profile
- Read a current article
- Read a previous article
- Post comment to discussion group
- Find a member named James
- Submit two articles provided (use "Test1" & "Test2" for Title, Keyword, & Abstract)
- Logoff
- Login to the site as "revo", pword "p"
- Review two articles just submitted (open them up to read them)
- Edit two abstracts submitted
- Accept Article 1
- Decline Article 2
- Logoff

2. Subjects

Five people unfamiliar with the system performed the set of tasks using five different computers with access to the Internet.

3. Data Collection(Time to Task)

Task	Avg Time	User 1	User2	User 3	User 4	User 5
1. Read abstract from current issue	46	**10**	23	35	**164**	0
2. Read abstract from October 2000 issue	55	**18**	29	39	24	**166**
3. Register yourself on the site	77	**97**	90	89	68	**40**
4. Update your member profile	151	151	150	**87**	**200**	169
5. Read a current article	48	**19**	62	42	**75**	42
6. Read a previous article	24	**20**	21	**35**	22	21
7. Post comment to discussion group	75	65	77	**140**	**40**	52
8. Find a member named James	28	22	32	23	**14**	**50**
9. Submit two articles provided (use "Test1" & "Test2" for	201	174	**145**	230	**455**	236

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Title, Keyword, & Abstract)

10. Logoff	13	9	14	13	7	23
11. Login to the site as "revo", pword "p"	31	27	17	23	65	21
12. Review two articles just submitted (open them up to read them)	150	61	150	40	420	77
13. Edit two abstracts submitted	42	47	23	34	na	63
14. Accept Article 1	60	11	19	19	222	30
15. Decline Article 2	9	5	12	10	na	8
16. Logoff	9	10	10	7	6	10
Totals	**1055 sec 17.6 min**	**746 sec 12.4 min**	**874 sec 14.6 min**	**866 sec 14.4 min**	**1782 sec 29.7 min**	**1008 sec 16.8 min**

4. Comments by Task Number

Task	User	Comments/Problems	Importance	Solution
1	4	I feel computer illiterate. It took awhile for me to find the first abstract. I did not check the "listing" carefully. It should not have taken so long.	Low	Training
2	3	Looked at Current Issue abstract page for hyperlink to previous issues.	Low	Training
	4	Much easier.		
3	1	Used full name for username then realized full name used later on page.	Low	None
	4	No problem		
4	1	Told to go to Member News after minute and half searching.	Medium	Rename "Member News" to "Member Info"
	2	Some confusion on what area to go to locate item for selection. No ability to change password.	High	Add ability to update password.
	3	Some confusion of where to go to find this link.	Medium	(see above)
	4	Actually comical. I should have been able to update much faster.	Medium	(see above)
	5	Confused as to which link really does this.	Medium	(see above)
5	2	Using the back down after reading the article caused some disappointment.	Low	Add back links to each article submitted.
	4	Kind of boring. [user took time to read submission guidelines filler article]		
6	None			
7	3	Confusion once at discussion forum [about] where to go to post general comments to forum.		
8	None			
9	4	Pitiful.		
10	None			
11	4	I tried logging in one time & it did not recognize my password so then I logged in as "revo" & "p", but then I resubmitted my user name & password.		
12	2	Looked at side menu prior to actual main web	Low	Add "Review"

		page to find "Review" hyperlink.		hyperlink to menu.
	4	Could not find test article 2. I even resubmitted article 2. This was frustrating. It said User not found. I know that it was submitted b/c the same screen came up as when I submitted article 1. Will not take article 2.		
	5	Problem getting out, used back button	Low	Should use menu
13	4	Can't do it. Can't find it.		
14	4	I wasn't sure if there was an icon that said accept or decline. I didn't see one so I didn't know what to do. I went under Article 1 (not test article 1) & went to post replies & typed in "I accept".		
15	4	Can't decline Article 2 b/c it's not on here.		

5. General Comments

User 1

- liked the easy menu on the L side
- would have liked more buttons like "continue" or "edit" or "previous" on some screens
- would like member directory to access member by just clicking on name rather than type in search
- liked the "accept" "decline" part of reviewing articles – it was very clear

User 2

- Left side web site [Member Info]
- [Reviewer Info]   Categorize
- Change password?
- Article submission – at the end provide hyperlink to submit 2nd article?
- When I clicked on Member News without logging in first I'm directed to proceed to "Site Registration". On the left side "site registration" is " Become a Member" > retentive observation, but wanted to note it. Consistency issue.

User 3

- Anyway to signal changes made to abstract
- Current article at top of page
- Navigation via "back button" vice hyperlink when in articles was cumbersome. Additionally, memory to have last position in article remember to allow user to return to that location vice top of article.
- Scrolling with menu side bar was somewhat irritating

User 4

- It was fun doing the test. Some parts were easy to decipher & execute. Other terms were vague (accept/decline). I didn't know if there was a difference b/t article & abstract. It think with time & patience, anyone can operate this website.

User 5

- No comments

6. Efficiency

The updating of the user profile caused some confusion. It is located under "Member News" which includes the members' article submission history and user profile. Perhaps there is a more intuitive name for this page than "Member News" such as "Member Info".

7. Errors

User 4 made numerous errors submitting the test articles and submitted Article 2 four times. The errors did not cause system problems but were frustrating to the user. To recover from this the reviewer had to delete to duplicate submissions.

8. Learnability/Memorability

Users appeared to become more comfortable with the system after the first few tasks were completed. For Task 9 (Submit two articles) users typically were able to submit the second article in less than half the time. This will be verified in future tests with a revised task list.

9. Satisfaction

Overall, users appeared satisfied with the site and were able to navigate the majority of it without problem, except as noted above.   There were some good suggestions to enhance consistency, such as renaming Become a Member to Site Registration. Another good suggestion is to add the ability to update the user's password. Some users did not like having to scroll through the menu options on the left side of the

screen. This is a problem when viewing the site on a monitor set to 800 x 600 resolution. The site was designed on a monitor set to a much higher resolution so this problem was not noticed. Reducing the size of the frameset would make the site more usable on lower resolution monitors.

I.   REDESIGN

Based on the usability study the following changes were made:

1. Logoff:

To logoff the site users had to return to the logon page and click Logoff. This was not intuitive so a link was created on the main menu to allow users to logoff.

2. Member News page:

The name of this page caused some confusion for some users so the name was changed to Member Info. Users were also given the ability to update their own profile and change their password.

3. Become a Member page:

This link in the menu was linked to a page titled Registration so for consistency it was changed to Site Registration.

4. Yellow Pages page:

The name of this page also caused confusion so it was changed to Member Directory to reflect the fact that this page provides a listing of current members.

5. Screen Resolution:

Some of the tests were conducted on 15-inch monitors set to 800x600 pixel resolution. At this setting the title and menu frameset took up a lot of valuable screen real estate that could be better filled with content.   The size of the title and menu frameset was reduced in size to enhance the users' experience on the site and allow them to see more content on the screen.

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APPENDIX C. PRESENCE-LITE REVISION HISTORY

J. **24 MAY 2001**

- Added What's Happening page to display upcoming events posted by any member
- Added Employment page for posting of job listings

K. **22 MAY 2001**

- Check for space in username (a space caused an error)
- Added function to capitalize first letters of first and last names
- Check for duplicate username and display friendly message if duplicate exists
- Added back link to registration error page

L. **4 MAY 2001**

- Reviewer polling for article acceptance added
- Reviewers can post comments on articles
- Added Editor functions to make changes to member profiles and to edit article abstracts
- Members can edit their own profiles
- Added Member Roles and Member login counter

M. **23 APRIL 2001**

- Added links to get Internet Explorer or Netscape Navigator
- Added Beta Comments to discussion forum
- Changed Member News to Member Info
- Changed Become a Member to Site Registration
- Installed links to download or view article template
- Added page detailing article submission procedure

N. **7 MARCH 2001**

- Added member profile update mechanism
- Added Logoff link
- Changed Yellow Pages to Member Directory
- Modified Search to search for username OR first name OR last name
- Created test script for usability testing along with 2 test files for uploading

O.   17 FEBRUARY 2001

- Added status and date_status fields to Article table in database
- Modified deletion mechanism to change status of article from pending to declined instead of removing from database
- Added article submission history to Member News page
- Added keywords to database and Article Submission page
- Created function getComboBox to create and populate drop down combo boxes from database data
- Added reviewer field and date of review to Article table in database

P.   9 FEBRUARY 2001

- Domain names presencelite.com, .net, and .org are registered

Q.   8 FEBRUARY 2001

- Login procedure returns user to requested page once authenticated

R.   7 FEBRUARY 2001

- Established filesystem structure for uploaded articles (grouped by month/year under /articles/ directory)
- Added five additional file upload boxes for supporting files
- Added error checking to file upload mechanism to prevent the omission of entries
- Once an article is declined the entire directory it was contained within is deleted

S.   4 FEBRUARY 2001

- Review mechanism put in place (reviewer has two choices: ACCEPT-post article to site or DECLINE-delete article completely)
- Added links to login page for access to reviewer and editor functions

T.   13 JANUARY 2001

- Linked articles to discussion forums (visitors can read posted comments, logged in members can post comments)

U. 10 DECEMBER 2000

- Implemented cascading stylesheet
- User is automatically logged in after registration
- Search page can find member name
- Created Links from Yellow Pages
- Changed default page to site description
- Implemented Member News page

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5.   Marine Corps Tactical System Support Activity
        Technical Advisory Branch
        Attn: Operations Officer
        Camp Pendleton, California

        _____

        _____

6.   Marine Corps Representative
        Naval Postgraduate School
        Code 037, Bldg. 330, Ingersoll Hall, Room 116
        Monterey, California

        _____

7.   Chairman, Code 32
        Department of Computer Science
        Naval Postgraduate School
        Monterey, California

        _____

8.   Professor Rudolph Darken, Code 32
        Department of Computer Science
        Naval Postgraduate School
        Monterey, California

        _____

9. Professor Ted Lewis, Code 32
    Department of Computer Science
    Naval Postgraduate School
    Monterey, California

    _____

10. Captain Michael Del Grosso (USMC)
    Carmel, California

    _____